EXPLORING THE ROLE OF SOMATIC MARKERS IN CONSUMER BEHAVIOR

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EXPLORING THE ROLE OF SOMATIC MARKERS IN CONSUMER BEHAVIOR

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The dissertation is composed of two papers, and attempts to draw a more complete picture of the processes underlying consumers' emotional experiences by studying antecedents of somatic marker activation and the downstream impact of activated somatic states on consumer behavior.

The first paper studies the downstream impact of activated somatic states on consumers' experience of regret. This paper challenges the predominant view in the literature that regret is a cognitive emotion that stems from deliberation by showing that the experience of regret can stem from spontaneous bodily arousal.

The second paper examines an antecedent and downstream consequences of somatic marker activation in a consumption setting. By examining how modes of payment (i.e., cash vs. card) impact the activation of somatic states and how the somatic states curb impulsive purchase intention, this paper contributes to the literature on mode of payment through more fundamental conceptualization of underlying emotional processes.

BIOGRAPHICAL SKETCH

Prior to joining the Ph.D. program at Cornell University, Joowon Park obtained a bachelor's degree in business from Korea Advanced Institute of Science and Technology. Joowon's primary research interest is to explore the factors influencing consumers' emotional experiences and further examine how emotions impact consumers' decisions and preferences.

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INTRODUCTION

Emotion has long been considered detrimental to sound decision making by philosophers as well as lay people. This tradition is well-reflected in the studies of decision research wherein emotion has not received much attention until recently. Decision researchers have traditionally viewed the process of decision making as a cognitive, emotion-free, process wherein decision makers deliberatively evaluate the consequences of choosing each alternative then choose an alternative that will maximize the utility. Behavioral decision theory focused largely on identifying cognitive errors people make in the process of evaluating each alternative and understanding heuristics that people use to simplify the decision process. The potential role that emotions could play in the decision process was largely ignored in the earlier studies of behavioral decision theory. This trend started changing as several decision theorists incorporated anticipated emotion in their decision models. For example, Bell (1982) and Loomes and Sugden (1982) incorporated anticipated regret into their decision models and argued that decision makers compare the utility associated with each decision alternative and choose the option that minimizes regret. Past few decades have witnessed a growing interest in understanding roles that different emotions play in decision making as researchers have studies how integral emotions (emotions that arise intrinsically from decision-relevant stimuli or decision process) as well as incidental emotions (emotions that arise from sources that are extrinsic to decision process) influence decision making. With the growing interest, it can be argued with no difficulty that contemporary decision research considers emotion to be

an integral part of decision making.

A question about emotions that has fascinated many psychologists is the way affect and cognition interact in the experience of emotions. The early research on emotions in modern psychology (i.e., post-behaviorism era) was led by psychologists who emphasized the role of cognitive appraisals on the experience of emotions. Magda Arnold, considered to be the pioneer of cognitive theory of emotion, laid the groundwork for decades of emotions research with the publication of her book "Emotion and Personality" (Arnold 1960). In this book, Arnold argued that in order to experience emotion towards a target object, a person needs to acquire factual beliefs (i.e., what is the object?) as well as evaluative beliefs (i.e., how is the object going to affect me?) about the target. Arnold believed that the cognitive processes involved in the acquisition of the factual and evaluative beliefs determine the specific emotions that a person experiences. Specifically, she proposed evaluation of the valence, presence, and coping potential to be three dimensions of appraisals that influence the experience of emotions. She used these three dimensions to specify the cognitive preconditions that induce different emotions. Arnold's cognitive theory of emotion had a significant impact on the research of Richard Lazarus who also proposed that cognitive appraisal plays an essential role in the experience of emotions (Lazarus 1966). Lazarus posited that a person appraises the implication of an event on her well-being, or the adaptational significance, and the result of this appraisal determines the type of emotion that the person experiences. Lazarus's theory is characterized by two types of appraisals: primary appraisal and secondary appraisal. Primary appraisal concerns the relevance of the event to the person's well-being whereas secondary

appraisal concerns the assessment of the person's ability and resources to cope with the event. This appraisal theory has had significant influence on the decades of emotion research that followed. A seminal work by Stanley Schachter and Jerome Singer (1962) also highlighted the role of cognition as an important ingredient of emotion. Schacter and Singer proposed that the state of physiological arousal by itself is not sufficient to induce an emotional state and its cause needs to be cognitively explained in order for a person to experience a specific emotion. To test this proposition, Schacter and Singer injected study participants with either an arousal-inducing substance or a placebo. Some of these participants were given the explanation that the injection will induce arousal while the other participants were not. Then the participants were exposed to a situation that could be used to cognitively attribute their aroused states. Consistent with the proposition, only the participants who were injected with the arousal-inducing substance and were not given the explanation for their aroused stated (and thus engaged in cognitive attribution of their aroused states) demonstrated signs of emotional experiences. The research program by Nico Frijda and colleagues (Frijda 1986; Frijda, Luipers, and ter Schure 1989) further contributed to this stream of research by suggesting that in addition to cognitive appraisal, emotions involve states of action readiness, the degree to which a person is prepared to interact with the environment.

The belief that cognitive mediation is a prerequisite of emotion was challenged by Robert Zajonc (1980). Zajonc argued that cognitive mediation is not necessary for a person to experience emotions. In a series of studies, Zajonc demonstrated "mere exposure" effect wherein repeated exposure to a stimulus increased liking of the

stimulus in the absence of conscious recognition. Zajonc went on to argue that affect and cognition are two distinct processes that can manifest without the involvement of the other. The debate between Zajonc and Lazarus on whether cognitive mediation is necessary in the experience of emotions continued for decades (Lazarus 1982; 1984; 1999, Zajonc 1984; 2000) and this question has intrigued many researchers interested in studying emotions.

Among several streams of research that suggests the separation of affect and cognition, and the stream that is of particular interest in my dissertation, is the studies of the somatic marker hypothesis (Damasio 1994). The research on the somatic marker hypothesis focuses on how emotions guide sound decision making by mediating the interaction between decision environment and decision maker. According to the somatic marker hypothesis, perception or anticipation of objects or events triggers reflexive changes in the bodily or *somatic* states of the perceiver. Such changes can take the form that is obvious to external observers (e.g., posture, facial expression), as well as the form that is very subtle and not as obvious (e.g., skin conductance, heart rate). The ensemble of somatic responses is defined as *emotion* which provides essential ingredients to the experience of conscious feelings and guides decision making. The somatic marker hypothesis suggests that the experience of emotion does not require cognitive mediation. Somatic responses can be induced from two types of inducers – primary inducers and secondary inducers. Primary inducers are objects or experiences the presence of which automatically induces pleasurable or aversive states. Somatic activation from primary inducers can be innate (e.g., fear response to a snake on a child's first encounter with a snake) as well as learned and shaped through

experiences during the socialization process (e.g., stress response to reviewers' comments on a rejected manuscript). Secondary inducers are the thoughts or memories of primary inducers. Recalled or hypothetical consideration of primary inducers can function as secondary inducers and induce somatic states that are associated with the corresponding primary inducers. It has been shown that amygdala plays an important role in the activation of somatic states in the presence of primary inducers and ventromedial prefrontal cortex (vmPFC) plays an important role in the activation of somatic states in the presence of secondary inducers. In summary, the somatic marker hypothesis posits that our body and brain play an essential role in the experience of emotion in reaction to different stimuli in the decision context and the emotion, which is the collection of bodily responses towards the stimuli, guides proper decision making.

The early interest in the study of how emotions, manifested as bodily and brain responses, guide beneficial decision making stemmed from the observation of Phineas Gage (Harlow 1868). Gage was an active young man who worked as a railroad construction worker, a smart and shrewd man who was an efficient worker and likeable person before an accident changed everything. Mishandling of explosives at work caused a large iron rod to penetrate through Gage's brain. Gage miraculously survived the accident and to everyone's surprise, the injury to the brain did not take away his cognitive abilities. He was still the same rational thinker that he had been before the accident. However, the brain injury brought about significant changes to Gage's personality and social behavior as he became seemingly unable to control his emotions. He became noticeably rude and violent to people he interacted with and his

judgment and decision making became myopic. The failure to regulate emotions cost Gage his professional career and his social life. The case of Phineas Gage and other patients with similar brain injuries stimulated interest among neuroscientists in understanding the interaction of affect and cognition in the experience of emotions and the important role that emotions play in guiding proper social behavior and decision making. This interest led to the programmatic studies of the somatic marker hypothesis.

Influenced heavily by its origin, typical empirical testing of the somatic marker hypothesis involves the comparison of the behavior and physiological responses between brain lesion patients whose emotional experiences are impaired and control participants without such brain damages. The decision task that researchers often implement to test the somatic marker hypothesis is Iowa Gambling Task (IGT, Bechara et al. 1994). In IGT, participants draw cards, one card at a time, from any of the four decks of cards. Each draw results in a gain and some of the draws result in a penalty and participants are given the goal of maximizing the game money they are given in the beginning. Unbeknownst to the participants, two of the decks are designed to be "good" decks – a single draw from either of these decks offers a small immediate gain of $50 but it comes with a smaller penalty of $250 per 10 draws. The two other decks are "bad" decks – a single draw from either of these decks offers a larger immediate gain of $100 but it comes with a severe penalty of $1250 per 10 draws. Thus, the game is structured such that it is more advantageous to draw from the "good" decks despite the smaller immediate gain. Since the structure is unknown to the participants, in the early stage, both participants with brain lesions and control

participants tend to choose more from the "bad" decks that offer larger immediate gains. As the task continues, control participants implicitly learn the structure from their experience and avoid the "bad" decks. However, the same experience of larger loss does not change the behavior of the participants with brain lesions as they continue to draws cards from the "bad" decks and go bankrupt. Researchers attribute the poor performance by brain lesion patients to the absence of somatic marker activation and emotions (Damasio 1996; Bechara et al. 1999; Bechara et al. 2000; Tranel et al. 2002). The direct support for the somatic account of the poor performance comes from the analyses of skin conductance pattern, a widely used measure of somatic marker activation (Bechara et al. 2000). After playing a few rounds and implicitly learn the structures, control participants experience higher anticipatory skin conductance activity when they consider drawing a card from a "bad" deck. However, no such changes are observable from the brain lesion patients. That is, the absence of emotion, captured by the absence of somatic marker activation, prevents people from identifying and avoiding disadvantageous decisions.

With the two essays in my dissertation, I extend the somatic marker hypothesis to the realm of consumer behavior by studying the antecedents of somatic marker activation and the downstream impact of activated somatic states in consumption contexts. In doing so I contribute to the literature on the somatic marker hypothesis by studying how environmental factors, rather than individual differences caused by brain damages, can influence somatic marker activation and how the activated somatic states function in the contexts that closely resemble our daily lives, rather than in a contrived task. Examining the role of bodily responses in addition to the traditional

self-report measure of emotion provides a researcher a unique opportunity to contribute to the study of consumers' emotional experiences (Shiv et al. 2005). Specifically, in my first essay, I examine the role of skin conductance response on consumers' experience of consumption regret. Previous research on regret has largely characterized regret as an outcome of deliberative thinking; that is, regret is based on and influenced by deliberative evaluations of behaviors. In this research, I argue that the feeling of regret can also stem from a spontaneous bodily response rather than from a higher order cognitive process. By investing the involvement of spontaneous bodily response in the experience of arousal, I contribute to the literature on regret by refining the regret construct. In my second essay, I investigate how different methods of payment results in differential activation of skin conductance responses and how the activated somatic state explains consumers' food purchasing decisions. The study shows that skin conductance level is higher when people pay with cash than with cards, and this effect of mode of payment is stronger when people make decisions on tempting yet unhealthy vice food items. The study further shows that people are less likely to buy those unhealthy food items when skin conductance level is higher. With these findings, I contribute to the literature on mode of payment through more fundamental conceptualization of underlying emotional process. Overall, in this dissertation, I seek to draw a more complete picture of the processes underlying consumers' cognition and emotions and contribute to both the literature in the somatic marker hypothesis and consumer research.

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PAPER 1: AROUSAL AS A SOMATIC MARKER IN THE EXPERIENCE OF CONSUMPTION REGRET

Regret is an emotion people experience when they realize their current situation would have been better had they made different decisions in the past. Because the painful experience of regret reminds people of mistakes they made in the past and motivates them to avoid the reoccurrence of similar mistakes, regret is considered a beneficial emotion that plays an active role in behavioral remediation (Pieters and Zeelenberg 2007; Saffery, Summerville, and Roese 2008; Zeelenberg 1999; Zeelenberg and Pieters 2007). Regret is a unique emotion that is often characterized as a *cognitive emotion*. In fact, early discussion of regret in behavioral science was led by Bell (1982) and Loomes and Sugden (1982) who introduced it in the study of behavioral decision theory, a field of study that traditionally viewed decision making as a deliberative process and largely ignored the role of emotions. Specifically, Bell (1982) and Loomes and Sugden (1982) incorporated regret into the calculation of utility function and characterized it as an outcome of cognitive comparison of what the current utility is and what the utility would have been had people chosen differently. That is, early research on regret conceptualized it as a cognitive construct that is experienced after careful deliberation of counterfactuals. The characterization of regret as a cognitive emotion is still a prevalent view in the literature. To quote a few influential researchers in the literature of regret, Zeelenberg (1999, p. 326) notes that "regret is the negative, cognitively based emotion that we experience when realizing or imagining that our present situation would have been

better had we acted differently" and Gilovich and Medvec (1995, p. 379) state that "judgment is more central to the experience of regret than, say, the experience of jealousy or anger." In their review of the literature on regret, Zeelenberg and Pieters (2007) argue that regret is a "cognitive emotion" the experience of which stems from higher order cognition that requires the reflection on the choices made as well as the alternatives that were not chosen.

In the current research, we challenge this prevalent view that regret is predominantly cognition and that deliberation plays an essential role in its experience. Building on the literature on the *somatic marker hypothesis* which suggests that conscious experience of feelings stems from the automatic reactions of human body and brain (Bechara and Damasio 2005; Damasio 1994; 1996), we propose that the experience of regret can stem from spontaneous affective reactions rather than from deliberative evaluation of the regrettable behavior and counterfactuals. Specifically we argue that a person experiences spontaneous bodily arousal when she is reminded of her regrettable past behavior and the intensity of this arousal determines how regretful the person feels about the behavior. We further argue that deliberating on the behavior changes the effect of arousal on regret. Thus, the current research contributes to the literature in regret by studying an important question about the interplay of affect and cognition in the experience of regret that remains unanswered (Inman 2007; Roese, Summerville, and Fessel 2007).

We examine the interplay of affect and cognition in the experience of regret in the context of food consumption regret, a domain where regret plays an important role in regulation and remediation of unhealthy behavior (Inman 2007). Habitual

consumption of unhealthy food items that are rich in sugar and fat could lead to negative health consequences such as weight gain, increased risk of diabetes, impaired immune system, and other chronic diseases. Furthermore, larger consumption quantities result in more regrettable consequences. How does an individual experience consumption regret? If an individual experienced consumption regret through a deliberative process as suggested by decision scientists, she would first evaluate the consequence of her vice consumption by considering the frequency and the amount of her consumption. Then she would identify alternative decisions she could have made (e.g., not consuming anything at all, consuming healthier options, etc.) then evaluate the consequences of those alternative actions. Finally, she would compare these consequences and experience stronger regret if there is a large discrepancy between the amount she consumed and the amount she could have consumed had she decided differently and weaker regret if there is a small discrepancy. While we agree that this is one possible way of experiencing consumption regret, we propose that there is an alternative approach that is influenced more by spontaneous affective reactions and is more representative of how people actually experience their consumption regret. Specifically, we argue that people can also experience consumption regret reflexively by attending to the spontaneous bodily arousal induced when they bring to their mind the mental image of the unhealthy food items they consumed. That is, if someone were to ask Mary how regretful she feels about her pizza consumption, Mary is more likely to rely on the negative arousal induced by the mental image of greasy pizza rather than consider how many calories she consumed from eating pizza and compare how many calories she could have cut down had she chosen salad instead.

While we focus on consumption regret in the current research to study the interaction of affect and cognition in the experience of regret, we believe the same framework can be applied to many other retrospective evaluations of regrettable behaviors. For example, if a person bought a pair of shoes a week before the sale, she could evaluate her regret either by considering the magnitude of the sale or by relying on the instant pang she experiences when she sees the sale sign on the shop's window. Similarly, if a person installed a new part to his car then hears a news about the safety issues regarding the part, he could evaluate his regret either by considering what other alternative brands he could have chosen and how much more expensive or cheaper they would have been or by relying on the instant pang he experiences as he hears the news about the safety issue.

In the following sections, we first review the literature that motivates our hypotheses and then present four experiments designed to test these hypotheses.

Conceptual Framework

Affective Evaluation of Regret

The somatic marker hypothesis is a stream of research that examines how emotions guide sound decision making by mediating the interaction between decision environment and decision maker (Bechara and Damasio 2005; Damasio 1994; 1996). According to the somatic marker hypothesis, perception of objects or events, whether actual or recalled, triggers reflexive changes in the bodily or *somatic* states of the

perceiver. These spontaneous reactions are shaped through learning from previous experiences with the target, and the reactions can take the form that is obvious to external observers (e.g., posture, facial expression), as well as the form that is very subtle and not as obvious (e.g., skin conductance, heart rate). The collection of somatic responses that take place even in the absence of effortful cognitive mediation is defined as *emotion* and this emotion provides important ingredients to the experience of conscious feelings and guides decision making. Somatic responses can be induced from objects or experiences the presence of which automatically induces pleasurable or aversive states (i.e., primary inducers) as well as the thoughts or memories of primary inducers (i.e., secondary inducers). Somatic responses can be innate (e.g., aversive feelings experienced from the smell of sewage) as well as learned and shaped through experiences during the socialization process (e.g., uneasy feelings to consume pizza after learning how fattening it can be). It has been shown that amygdala and ventromedial prefrontal cortex in human brain play an essential role in the activation of somatic states. In sum, the somatic marker hypothesis posits that our body and brain play an important role in the experience of emotions in reaction to different stimuli and the experience of emotions does not require effortful cognitive mediation. It should be noted that while the terms "emotion" and "feeling" are often used interchangeably by many researchers, the two terms refer to different phenomena in the study of the somatic marker hypothesis as the former refers to the collection of bodily responses to stimuli while the latter refers to more conscious experience that results from the former. In this research, we characterize the experience of bodily arousal as "emotion" and characterize the conscious experience of regret as "feeling."

Typical empirical testing of the somatic marker hypothesis involves the comparison of the behavior and physiological responses between patients who have brain lesions that prevent emotional experiences and control participants without such brain lesions. The task that researchers often implement in the testing of the hypothesis is Iowa Gambling Task (IGT, Bechara et al. 1994; 2000) wherein participants draw cards, one card at a time, from any of the four decks of cards. Unbeknownst to the participants, half of the decks are designed to be riskier than the other half and the task is designed such that it is more prudent to avoid these riskier decks. Participants without the brain lesion implicitly learn the structure with the help of negative feelings and avoid the riskier decks as the task proceeds to the later rounds. However, patients with the brain lesion whose decisions are not guided by their emotional experiences fail to learn the structure, keep drawing from the riskier deck, and perform poorly in the task. The involvement of bodily responses in this performance discrepancy is clearly demonstrated with the pattern of skin conductance, a widely used measure of somatic marker activation (Bechara et al. 2000). Whereas the control participants without the brain lesions experience increase in skin conductance when they experience or anticipate loss but this pattern of skin conductance activity is not found among the brain lesion patients. These findings support the somatic marker hypothesis by showing that spontaneous reactions at the bodily level provide essential ingredients for the conscious experience of feelings, which in turn guides behavior and decision making.

Following the somatic marker hypothesis, we posit that the conscious experience of regretful feeling can stem from spontaneously elicited and negatively-

valenced physiological arousal. When a person is reminded of her past consumption of sugary doughnuts or calorie-rich pizza, to the extent such stimuli are categorized as unhealthy in her cultural milieu, she will spontaneously experience physiological arousal, which is a learned affective response to the food items that are automatically categorized as vice. Once this arousal is experienced in the body proper, she will rely on this arousal to reflexively evaluate how regretful her past consumption feels without considering the extent (i.e., frequency or consumed calorie amount) of consumption. Therefore, we hypothesize that consumption regret is sensitive to the intensity of bodily arousal but insensitive to the extent of consumption.

Deliberative Evaluation of Regret

While we argue that natural evaluation of consumption regret stems from spontaneous bodily arousal, we do not suggest that people cannot experience regret through deliberative consideration of consumption extent (i.e., consumption frequency or calorie consumption amount). People naturally neglect the deliberative analysis of consumption extent not because it is perceived to be irrelevant but because the deliberative process is not fast enough to enter the picture before people have already experienced regretful feeling through the spontaneous affect-driven process (for the discussion on the relative speed of affective and reflective processing, see Kahneman and Frederick 2002; Metcalfe and Mischel 1999; Zajonc, Pietromonaco, and Bargh 1982). How would people evaluate consumption regret when they do consider the extent of their consumption? How would the bodily arousal and the deliberation on

consumption extent interact to influence the experience of regret?

A long tradition of folk wisdom dating back to the discussions of Greek and Roman philosophers in portraying the interplay of affect and cognition has led to the lay belief that deliberative cognitive evaluations are more diagnostic or useful than spontaneous affective evaluations (Anderson 2007; Baumeister, DeWall, and Zhang 2007). We argue that due to this lay belief, people generally consider deliberative evaluation of the extent of the behavior to be more diagnostic than arousal-based affective evaluation when making evaluative judgments. This is particularly true in the context of consumption evaluation where consumption estimation such as counting calories is generally believed to be a useful tool for evaluating unhealthiness. Extent evaluations in consumption behavior typically entail quantification of the extent of the consumption. In the context of consumption behavior evaluations, examples of extent evaluations are consumption rate evaluation (e.g., "how many servings did I consume per week") or calorie estimation (e.g., "how many calories did I consume"). People have a lay belief that such quantitative evaluations are more diagnostic than evaluations based on affective reactions to the unhealthiness of the food item.

According to the literature in memory-based evaluation, when more than one source of input is available and accessible during an evaluation, the input with higher perceived diagnosticity or relevance is more likely to be used while others are ignored (Feldman and Lynch 1988; Lynch, Marmorstein, and Weigold 1988). Therefore, when both bodily arousal and the deliberatively considered consumption extent are available and accessible for regret evaluation, we argue that people rely on deliberative extent evaluation that is perceived to be more diagnostic while relying less on bodily arousal

that is perceived to be less diagnostic.

Contextual Cues Can Influence Regret Evaluation

Perceived diagnosticity is a heuristic assessment of the necessity and the sufficiency of the informational input to make the judgment. Because perceived diagnosticity is a heuristic assessment, it can be influenced by contextual cues. During regret evaluation, contextual cues can enhance the perceived diagnosticity of the bodily arousal. When both bodily arousal and deliberative consideration of consumption extent are equally accessible, people generally consider deliberative extent evaluations to be more diagnostic, end up relying less on arousal. However, even when both inputs are accessible, if contextual cues increase the perceived diagnosticity of arousal-based affective evaluations, people will rely on bodily arousal. That is, consumption regret can be sensitive to bodily arousal even when the extent of consumption is made salient if contextual cues increase the perceived diagnosticity of arousal.

In summary, this research proposes a parsimonious framework to predict behavior evaluations by building on the somatic marker hypothesis (Bechara and Damasio 2005; Damasio 1994; 1996). Three guiding principles are proposed to explain how people experience regret. First, people usually experience consumption regret by relying on bodily arousal while neglecting the extent of their consumption. Second, increasing the salient of consumption extent makes people attentive to extent evaluation but this reduces attention to arousal. Third, if contextual cues increase the

perceived diagnosticity of arousal, people do not neglect arousal even when consumption extent is salient. Now we present four experiments that test this framework.

Overview of Studies

We conducted four experiments to test these hypotheses. In study 1, we demonstrate arousal-based evaluation of regret using skin conductance data and show that making salient the extent of consumption reduces attention to arousal. In study 2, we demonstrate extent neglect during arousal-based evaluation and explore the nature of deliberative evaluation of regret. In study 3, we manipulate the salience of arousal and consumption extent and in study 4, we manipulate the perceived diagnosticity of arousal to further examine the interplay of affect and cognition in the experience of consumption regret.

Study 1: The Role of Spontaneous Arousal in the Experience of Regret

This study was designed to demonstrate the role of arousal in the experience of consumption regret. Participants were asked to evaluate how much they regret their consumption of calorie rich food such as cakes, cookies, and pizza. Some participants made the evaluation without any prompt (natural mode) whereas the others were asked to consider the extent of their consumption before making the evaluation (deliberative mode). We predicted that consumption regret experienced by participants in the

natural mode (who were not prompted to consider the extent of their behavior) will be highly sensitive to the intensity of bodily arousal whereas consumption regret experienced by participants in the deliberative mode will be less sensitive to the intensity of bodily arousal. To test these predictions, we measured participants' skin conductance levels (electrodermal activity: EDA), a commonly used physiological measure of arousal, as they evaluated their consumption regret. This physiological measure enables us to test the specific mechanism through which arousal and deliberation interact during the experience of consumption regret. There are two different ways through which deliberating on consumption extent can reduce the effect of arousal on consumption regret: it could either reduce the intensity of arousal (*arousal intensity account*) or it could reduce the attention to arousal without affecting the intensity (*arousal attention account*). Per the intensity account, we should expect to see higher level of arousal in the natural mode and relatively lower level of arousal in the deliberative mode. Per the attention account, we should expect to see similar levels of arousal in the two modes but observe higher correlation between arousal and consumption regret in the natural mode than in the deliberative mode. We test both of these possible mechanisms in this study.

In addition, to show that the effect of deliberation on arousal is robust across different time frames used for deliberative extent evaluation, we included a narrow frame of extent evaluation (number of servings per day) as well as a broad frame of extent evaluation (number of servings per year). Thus, this experiment uses a three cell design with three different evaluation modes: natural, extent-deliberation 1 (number of servings consumed per day), and extent-deliberation 2 (number of servings consumed

per year). Finally, we wanted to compare the intensity of consumption regret experienced in the natural mode and the deliberative mode to see if the different ways through which regret is experienced also result in different intensity of consumption regret. Therefore, the intensity of physiological arousal and the intensity of reported consumption regret were the main dependent measures in this study.

Method

Participants and Design

The experiment was administered in a behavioral laboratory at a U.S. university. One hundred and one students (57 women; age 20.8 years) from the university campus were recruited to participate in a thirty-minute session. They were paid $5 for their participation in a series of unrelated studies that lasted for about 30 minutes. The study used a 3 (evaluation mode: natural, extent-deliberation 1 (daily), extent-deliberation 2 (annual)) x 9 (food category replicates: chocolates/candies, cakes, cookies, doughnuts, French fries, hotdogs, potato-chips, soda, and pizza) mixed factorial experimental design with evaluation mode as a between-subjects variable and food category as a within-subjects variable.

Procedure

A research assistant familiar with skin conductance measurement protocols administered the experiment, one participant at a time, in the laboratory. Before participating in the main study, participants were asked to wear Affectiva's electrodermal activity (EDA) measurement device on the palms of their non-dominant

hands (see Appendix 1A). The research assistant ensured that participants' palms were dry and clean before the EDA measurement device was strapped on. After the device was strapped on their non-dominant hands, participants responded to the questionnaires on the computer screen with their dominant hands. The time on the computer was synchronized with the time on the EDA measurement device, so that we could associate each skin conductance reading to the task on the computer screen. The EDA measurement device recorded EDA in microsiemens at the rate of 2 recordings per second. Trial runs with the EDA measurement apparatus revealed that skin conductance levels increase slowly and it takes several minutes before the EDA level stabilizes for a participant. To ensure that the skin conductance levels are stabilized before the main study (i.e., the consumption regret study), participants were asked to clench and stretch their hands 10 times, and read aloud 36 simple and complex multi-syllable linguistic stimuli.

Baseline EDA

Baseline EDA is the average tonic level of an individual's EDA in the absence of the test stimulus. It is customary to control for the baseline skin conductance levels to remove the variance in data caused by individual differences in baseline levels of EDA (see Boucsein 1992 for a detailed discussion). To measure baseline skin conductance, at the beginning of the main study, all participants were exposed to an initialization screen titled "Food study" with pictures of some food items and a brief instruction that this is a survey on consumption of some food items. This screen was identical across all conditions. For each participant, the average skin conductance measured on this initialization screen was used as the baseline skin conductance level.

Random Assignment to Conditions

After the measurement of baseline EDA, participants were randomly assigned to one of three conditions. For each food category, participants in the extent-deliberation 1 (daily) condition were asked to report how many servings they consume per day before reporting their consumption regret. They submitted their responses using an open ended text response box. Similarly, participants in the extent-deliberation 2 (annual) condition were asked to report how many servings they consume per year. Participants in the natural condition were not asked to consider their consumption quantity.

Consumption Regret

Next, all participants were asked to evaluate how regretful they felt about the consumption of the food items in the nine categories. For each of the nine food categories, participants indicated their regret on a five point semantic differential scale (1= no regret at all, 5= very strong regret). The EDA apparatus recorded the EDA as participants evaluated their regret. Appendix 1B lists the details of the questions used in this study.

Results

The device used for EDA measurement did not record the skin conductance data for four participants (presumably because the contact between the electrodes and the skin was weak or because participants accidentally turned off the device). Additionally, one participant had the skin conductance device strapped on his

dominant hand with which he operated his mouse (contrary to the instructions). We excluded the responses from these five participants and used the data from the remaining 96 participants for our analyses.

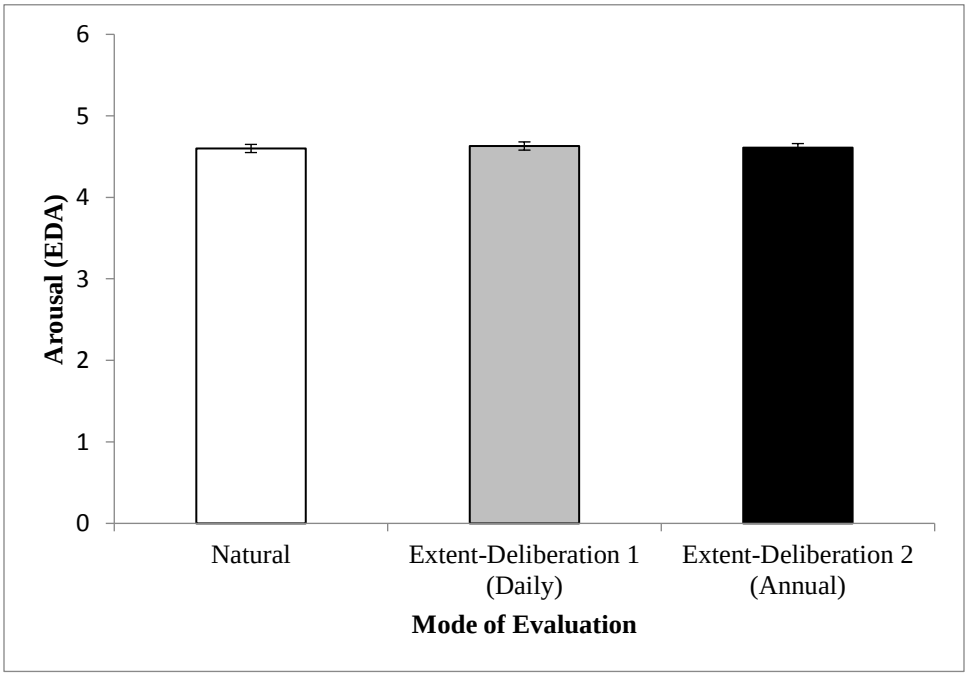
Arousal Intensity

Since EDA measurements were collected at the rate of 2 recordings per second, for each participant we averaged the EDA recordings from the regret evaluation for each of the nine food categories. Thus, for each participant, we identified nine average EDA responses, one from the regret evaluation of each of the nine food categories. The average EDA responses varied from 0.12 microsiemens to 17.92 microsiemens. This is consistent with observations reported in previous research (Boucsein 1992). To control for individual differences in baseline EDA, we identified the baseline EDA response for each participant. For each participant, the baseline EDA response was determined as the mean of EDA responses recorded during the initialization screen at the beginning of the main study.

First, we tested whether the mode of evaluation changed the intensity of arousal. For this purpose, the EDA measurements recorded during the regret evaluation were submitted to a mixed model ANCOVA with evaluation mode as a between-subjects variable and food category replicate as a within-subjects factor. To control for the effect of individual differences in baseline levels of EDA, baseline EDA was entered as a covariate in the model. The intensity of arousal did not change across the conditions, ($M_{natural}$ = 4.60, $M_{extent\text{-}deliberation1(daily)}$ = 4.63, $M_{extent\text{-}deliberation2(annual)}$ = 4.61), $F(2, 92) = 0.05$, $p > .94$. Figure 1A visually depicts the EDA responses across three conditions. This result suggests that deliberating on

consumption extent does not change the intensity of experienced bodily arousal per se. Thus, the arousal intensity account, which suggests that deliberating on consumption extent could reduce the intensity of arousal, is not supported.

Figure 1A: Deliberating on Consumption Extent Does Not Influence Arousal Intensity (Study 1)



Attention to Arousal

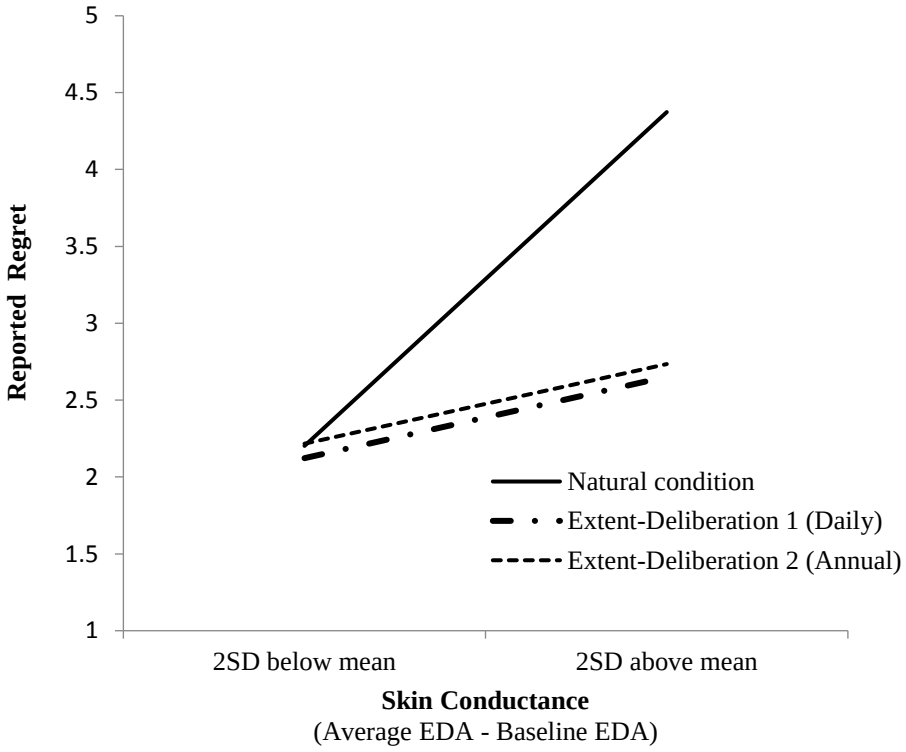
Next, we tested the arousal attention account, namely, whether deliberating on the extent of consumption reduces the effect of arousal on the experience of regret without affecting the experienced intensity of arousal per se. First, as preliminary model-free evidence, we conducted correlation analyses, separately for each evaluation mode condition, to examine the correlation between baseline-line adjusted

EDA and consumption regret. We adjusted for the individual differences in EDA by subtracting the baseline EDA from the average EDA responses following the procedure recommended by Boucsein (1992). As predicted, the correlation between EDA and regret was stronger in the natural condition ($r = .28$, $p < .001$) than in extent-deliberation 1 (daily) condition ($r = .10$, $p = .10$) or in extent-deliberation 2 (annual) condition ($r = .16$, $p < .01$). While such correlational analyses do provide preliminary evidence, they fail to take into account the fact that multiple observations were made from each individual participant.

To account for repeated observations from each participant, we ran repeated measures regression analyses capturing the effect of arousal on regret in the three conditions. The analyses were done using the MIXED Procedure in SAS. Reported regret was regressed on baseline-adjusted EDA, dummy variable 1 (set to 1 for daily condition and 0 for the other conditions), dummy variable 2 (set to1 for the annual condition and 0 for the other conditions), the interaction term of baseline-adjusted EDA and dummy variable 1, and the interaction term of baseline-adjusted EDA and dummy variable 2. The coefficient of EDA was positive and significant in this model, $\beta = 1.63$, $p < .001$, suggesting that consumption regret in the natural condition increased with arousal intensity. The interaction between dummy variable 1 and EDA was marginally significant, $\beta = -1.23$, $p = .06$, suggesting that the effect of EDA was weaker in the daily condition than in the natural condition. Similarly, interaction between dummy variable 2 and EDA was significant, $\beta = -1.24$, $p < .05$, suggesting that the effect of EDA was also weaker in the annual condition than in the natural condition. A follow up analysis of simple slopes (Aiken and West 1991) showed that

EDA was not a significant predictor of regret in neither the daily condition, $\beta = .40$, $p > .35$, nor the annual condition $\beta = .39$, $p > .25$. Figure 1B visually depicts the relationship between regret and EDA responses across three conditions. The discrepancy between the natural mode and the deliberative mode also suggests that people do not naturally deliberate on the extent of consumption during their evaluation of consumption regret.

Figure 1B: Deliberating on Consumption Extent Reduces Attention to Arousal (Study 1)



These results support the arousal attention account and suggest that naturally, the experience of consumption regret stems from spontaneous bodily arousal but

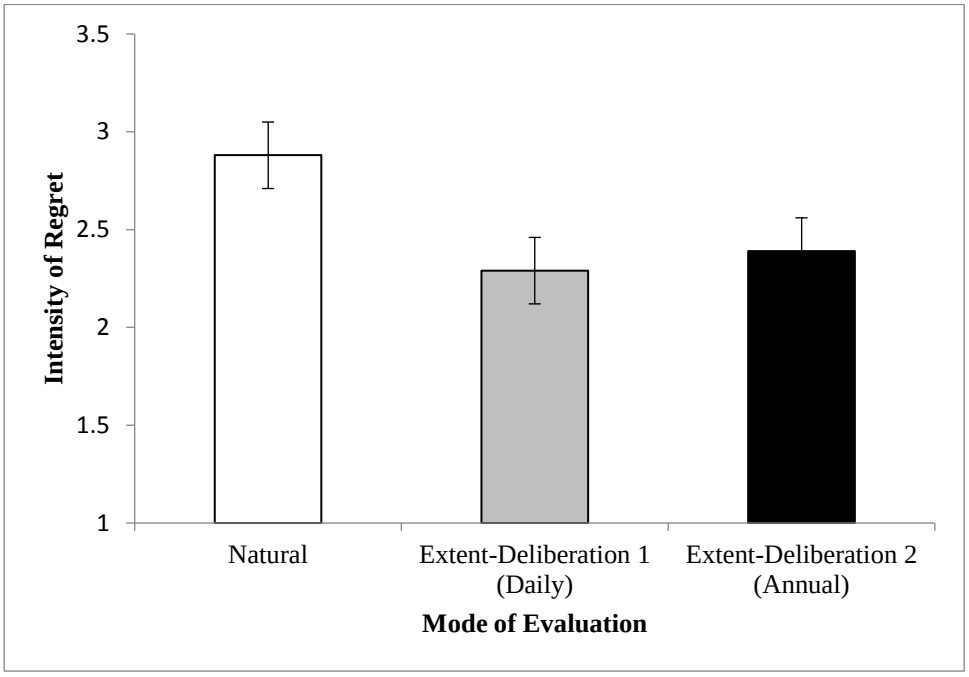
deliberating on the extent of consumption reduces the effect of arousal on consumption regret.

Intensity of Consumption Regret

Next, we tested whether different ways of evaluating consumption arousal influenced the intensity of experienced consumption regret. Reported regret was compared using a mixed-design ANOVA with evaluation mode as a between-subjects factor and food category replicate as a within-subjects factor. There was a significant effect of evaluation mode on reported regret ($M_{natural}$ = 2.88, $M_{extent\text{-}deliberation1(daily)}$ = 2.29, $M_{extent\text{-}deliberation2(annual)}$ = 2.39), $F(2, 93) = 3.16$, $p < .05$. Figure 1C presents a summary of the results across the three conditions. Planned contrast analyses suggest that regret evaluated in the natural condition was higher than regret reported in the extent-deliberation 1 (daily) condition, $F(1, 93) = 5.56$, $p < .05$, as well as the extent-deliberation 2 (annual) condition, $F(1, 93) = 3.64$, $p = .06$. That is, deliberating on the extent of consumption reduced the intensity of experienced consumption regret. Again, the discrepancy between the natural mode and the deliberative mode suggests that people do not naturally deliberate on the extent of consumption when they evaluate consumption regret. Not surprisingly, the effect of food categories was significant $F(8, 744) = 5.17$, $p < .001$, suggesting that regret differed across food categories.

Figure 1C: Deliberating on Consumption Extent

Reduces the Intensity of Consumption Regret (Study1)



Discussion

In this experiment, we tested whether the experience of regret naturally stems from spontaneous bodily arousal rather than from deliberation. We asked participants to indicate their consumption regret either naturally or after deliberating on the extent of their consumption. Participants' EDA activities were measured throughout the study. The analysis of the EDA data suggests that the experience of consumption regret naturally stems from spontaneous bodily arousal but deliberating on the extent of consumption reduces the effect of arousal on consumption regret. The difference in the effect of arousal on regret across different modes of regret evaluation was not

caused by the different level of bodily arousal per se – deliberating on consumption extent did not reduce the intensity of arousal that participants experienced. However, participants who deliberated on their consumption extent did not attend to their bodily arousal presumably because the deliberation of consumption extent was perceived to be a more diagnostic input in the evaluation of consumption regret than bodily arousal. The proposed reliance on consumption extent in the deliberative mode will be more closely examined in study 2. We also found that experienced consumption regret was more intense when participants evaluated it naturally than when they evaluated it after deliberating on their consumption extent. While the different patterns found between the natural mode and the deliberative mode is suggestive of the possibility that people naturally do not deliberate on their consumption extent to evaluate consumption regret, the current study lacks direct evidence to support this claim. Also, it is not clear yet from this study why the intensity of regret is lower when people deliberate on their consumption extent. We answer these questions in the next study by directly examining the effect of consumption extent on consumption regret.

Study 2: Direct Evidence of Changes in Extent Sensitivity

This study was designed to serve two purposes. First, we directly test whether sensitivity to consumption extent changes across the two modes of evaluation. As in study 1, consumption regret was measured. All participants were asked to report how much they regret their past consumption, and estimate and evaluate the extent of their consumption. The order of these questions was manipulated across two conditions.

Half of the participants were asked to first estimate the extent of their consumption and evaluate the extent, and then report their consumption regret (deliberative mode). The other half first reported how much they regret their past consumption without any prompt and then estimated the extent of their consumption and evaluated the extent (natural mode). We examined to what extent their consumption regret was influenced by the extent of consumption. We predicted that consumption regret of the participants in the deliberative mode condition would be sensitive to the participants' extent evaluation while regret of the participants in the natural mode condition would be less sensitive to the extent evaluation. In addition, using the extent sensitivity patterns in the two conditions, we explain why deliberating on consumption extent to evaluate regret reduces the intensity of regret.

Second, to establish the generalizability of our results, we adopted a different type of extent evaluation with different time frame – namely, estimation of consumed calories per week. In addition, whereas study 1 was conducted in a lab setting with undergraduate students as participants, to further establish generalizability, this study was conducted in an online setting with a more representative sample on the internet.

Method

Participants and Design

The experiment was administered as an internet-based study to participants recruited from an online panel. One hundred and two participants (59 women; average age: 31.8) completed the study for a small amount of money. The study had two

between-subjects conditions (evaluation mode: natural, deliberative) and six food category replicates (cakes, doughnuts, cookies, potato chips, ice cream, chocolates & candies) were used.

Procedure

Participants were randomly assigned to one of the two between-subjects conditions (evaluation mode: natural, deliberative). Participants assigned to the *deliberative condition* were first asked to estimate their weekly calorie consumption amount for each of the six food categories. Participants submitted their estimates in open-ended text boxes. In addition, they were asked to evaluate the extent of their consumption behavior. Specifically, for each food category, they evaluated the extent of their consumption amount on a 5-point scale (1: low – 5: high). This subjective evaluation of consumption extent was conducted to account for individual differences; while some people could consider consuming 400 calories from candies per week high, others might consider the same amount low. Subsequently, they reported their consumption regret. The order of the questions was changed for participants assigned to the *natural condition*. These participants first reported their consumption regret without any prompt, then estimated their weekly calorie consumption amount, and finally evaluated the extent of their consumption amount using the 5-point scale.

Finally, participants indicated their current mood (1 = very bad, 7 = very good), their involvement with the task (involved, attentive, careful, thoughtful), and demographic information including weight and height later used to compute BMI. An instructional manipulation check was administered in the end to identify participants who might not have followed the instructions (Oppenheimer, Meyvis, and Davidenko

2009) (see Appendix 2A for details of the questions used in this study). The measures reported in this paragraph were administered in all of the online studies (study 2, study 3, and study 4) reported in this paper.

Results

Participants who failed the instructional manipulation check questions and those whose log-transformed completion time was more than three-standard deviations away from the mean were excluded from the analyses in this study and the other internet-based studies reported in this paper. Fourteen participants who failed the instructional manipulation check question and one participant who was an outlier on response time were excluded in this study. So the following results are based on responses from the remaining 87 participants. This data exclusion was done as a matter of abundant caution to reduce the effect of idiosyncratic participants; including these participants does not change the main results. The results of analyses without the exclusion are provided in the Appendix 2B.

Intensity of Regret

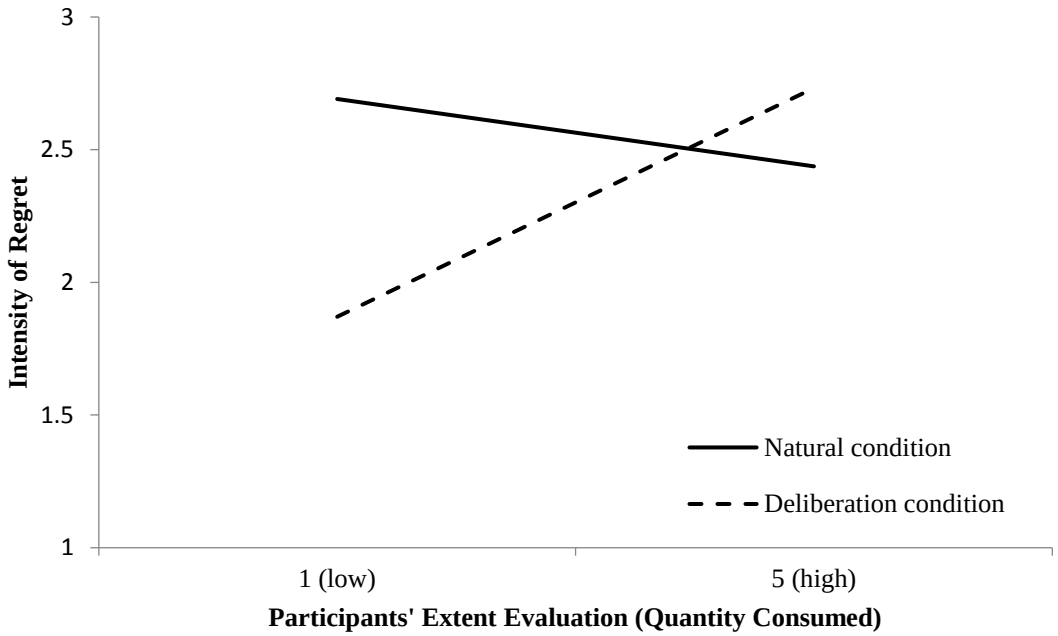
Reported regret was submitted to a 2 (evaluation mode: natural vs. deliberative) x 6 (food category) mixed model ANCOVA with evaluation mode as a between-subjects factor and food category as a within-subjects factor. To reduce the noise potentially caused by the heterogeneity of the online participants, participants' BMI was entered as a covariate in the model. Replicating the result from the previous study, reported regret was higher when it was evaluated in the natural mode than in the

deliberative mode ($M_{natural}$ = 2.60, $M_{deliberative}$ = 2.10), $F(1, 84) = 4.02$, $p < .05$. The effect of food categories was significant, $F(5, 425) = 3.21$, $p < .01$, suggesting that reported regret differed across food categories.

Attention to Consumption Extent

To test whether attention to consumption extent varied across conditions, we ran repeated measures regression analyses capturing the effect of participants' extent evaluation on reported regret in the two conditions. The analyses were done using the MIXED Procedure in SAS. Reported regret was regressed on extent evaluation, a dummy variable set to 1 for the deliberative condition, and their interaction term. In addition, the model controlled for participants' BMI. The predicted interaction between the dummy variable and extent evaluation was significant, $\beta = .28$, $p < .001$, suggesting that the effect of extent evaluation on the intensity of experienced regret varied across the two conditions. A follow up analysis of simple slopes (Aiken and West 1991) showed that extent evaluation was a positive and significant predictor of regret in the deliberative condition, $\beta = .21$, $p < .001$. But the slope of extent evaluation was not significant in the natural condition, $\beta = -.06$, $p > .14$. Figure 2 depicts the relationship between regret and participants' extent evaluation across two conditions. This result is consistent with our conceptualization that people do not deliberate on consumption extent when they naturally evaluate regret but increasing the salience of extent mitigates this extent neglect because deliberative extent evaluation is perceived to be more diagnostic than bodily arousal.

FIGURE 2: Consumption Regret is Sensitive to Consumption Extent Only When Extent is Made Salient (Study 2)



We used the Johnson-Neyman technique (Johnson & Neyman, 1936) to identify the ranges of participants' extent evaluation for which the simple effect of the evaluation mode was significant. This analysis revealed that there was a significant positive effect of the evaluation mode (coded 1 for the natural condition and 0 for the deliberative condition) on reported regret when extent rating was less than 3.15 (β =.28, SE = .14, p = .05). Combined with the pattern of extent neglect in the natural mode of evaluation, this result suggests that the discrepancy in the intensity of regret between the natural mode and the deliberative mode is driven largely by participants in the natural mode condition whose consumption amount is small or moderate. These participants experience unwarranted regret because they do not naturally take into

consideration the fact that their consumption extent is justifiably low and so they do not have to feel too regretful about their consumption.

Confound Checks

There was no effect of evaluation mode on participants' mood ($p > .56$). The four involvement measures were highly correlated ($\alpha = .94$) so we computed the mean of the four items to come up with a composite measure of involvement. There was no effect of evaluation mode on the composite measure of involvement ($p > .81$).

Discussion

This study directly shows that people do not deliberate on their consumption extent during the evaluation of consumption regret unless they are prompted to consider it. Replicating the result from the previous study, reported consumption regret was higher when it was evaluated in the natural mode than in the deliberative mode. Importantly, the pattern of extent sensitivity suggests that this discrepancy in the intensity of regret is driven largely by participants who perceive their consumption extent to be low: When the consumption extent was made salient, these participants evaluated their consumption regret to be accordingly low. However, when the extent was not made salient, these participants failed to adjust their consumption regret to be accordingly low because their evaluation was anchored largely by their affective reactions to the food items. These results suggest that extent neglect matters more for prudent consumers; it is the people who consume in moderation that evaluate their behavior more harshly than they should.

The pattern of results in the first two studies suggest that people neglect deliberative extent evaluation because it is not as salient as arousal. When the salient of deliberative extent evaluation is high, people attend less to arousal because extent evaluation is perceived to be more diagnostic than arousal. Study 3 and study 4 are designed to further investigate the role or salience and diagnosticity of these inputs in the experience of consumption regret. These studies show that subtle contextual cues that influence salience and diagnosticity of these inputs can influence how people experience consumption regret. The next two studies not only test the predictive value of the proposed theoretical framework but also illustrate the situational contingency of arousal and deliberative evaluation in the experience of regret.

Study 3: Contextual Cues Can Increase the Salience of Consumption Extent

In the previous two studies, we increased the salience of deliberative extent evaluation by directly asking participants to consider the extent of their consumption. Can contextual cues that increase the salience of extent evaluation reduce extent neglect? Using a procedure similar to that used by Hsee and Rottenstreich (2004), we primed the salience of affective arousal-based and deliberative extent-based evaluations. Participants were exposed to one of two different advertisements before evaluating their consumption regret; one primed them to do affective arousal-based evaluation whereas the other primed deliberative extent-based evaluation. We expected this priming to increase the salience of affective and deliberative evaluation respectively. Subsequently, they evaluated their consumption regret either in the

natural mode or the deliberative mode. We predicted that priming extent evaluation would increase the salience of extent evaluation and thus prevent extent neglect even when participants are not explicitly prompted to consider their consumption extent. Also, we predicted that the deliberative evaluation mode would reduce the effect of the arousal-based prime because of the higher diagnosticity of deliberative extent evaluation compared to affective evaluation. It should be noted that building on the findings from the previous studies, we use relatively higher intensity of regret as an indicator of arousal-based evaluation of regret and lower intensity of regret as an indicator of extent-based evaluation of regret.

Additionally, instead of using infrequently consumed food categories as in our previous studies (e.g., cookies, cakes, ice cream etc.), we chose more frequently consumed food categories (burgers & pizzas, fried food, and desserts) to further establish generalizability and rule out the possibility that the patterns shown in the current research manifest only when narrow categories are considered and thus consumption quantities are very small.

Method

Participants and Design

The experiment was administered as an internet-based study to participants recruited from an online panel. One hundred and ninety-two participants (99 women; average age: 33.6) completed the study for a small amount of money. The study used a 2 (evaluation mode: natural vs. deliberative) x 2 (prime type: affect-based vs. extent-

based) x 3 (food category replicate: burgers & pizzas, fried food, and desserts) mixed factorial experimental design with evaluation mode and prime type as between-subjects factors and food category replicate as a within-subjects factor.

Procedure

Participants were randomly assigned to one of the four between-subjects conditions created by crossing evaluation mode and prime type. Participants were told that they will be asked to complete several unrelated questionnaires. In the first part of the study, participants were told that they will be shown a poster that will be used for a campaign in the future and their task is to take a careful look at the poster to answer several questions later. On the following screen, all participants saw a poster. A hidden timer was added to the webpage so that participants had to spend at least 20 seconds on the webpage before advancing to the next webpage. Participants in the affect-based prime condition were shown a poster with a slogan "Fat lasts longer than flavor" accompanied with an aversive picture of a thin person holding five pounds of body fat. Participants in the extent-based prime condition were shown a poster with a slogan "Let's move!" accompanied with a picture of a healthy couple running. This slogan was adapted from the first lady Michelle Obama's "Let's move" campaign. Importantly, this poster provided information on the amount of calories that can be burned from 30 minutes of walking, running, and swimming to make extent salient, priming extent of behavior (see Appendix 3A for the stimuli).

In an ostensibly unrelated survey on consumption of food items, participants were asked to evaluate how much they regret their consumption of food items in three categories (burgers & pizzas, fried food, and desserts). Before evaluating their regret,

participants in the deliberative evaluation condition were first asked to estimate, for each food category, how many calories they consume per month.

Finally, as a manipulation check participants saw the poster they were shown earlier and indicated whether they consider the poster as being emotional in nature or using quantitative information (1: emotional – 7: quantitative). Participants also responded to the other confound check measures and demographic variables reported in the previous study.

Results

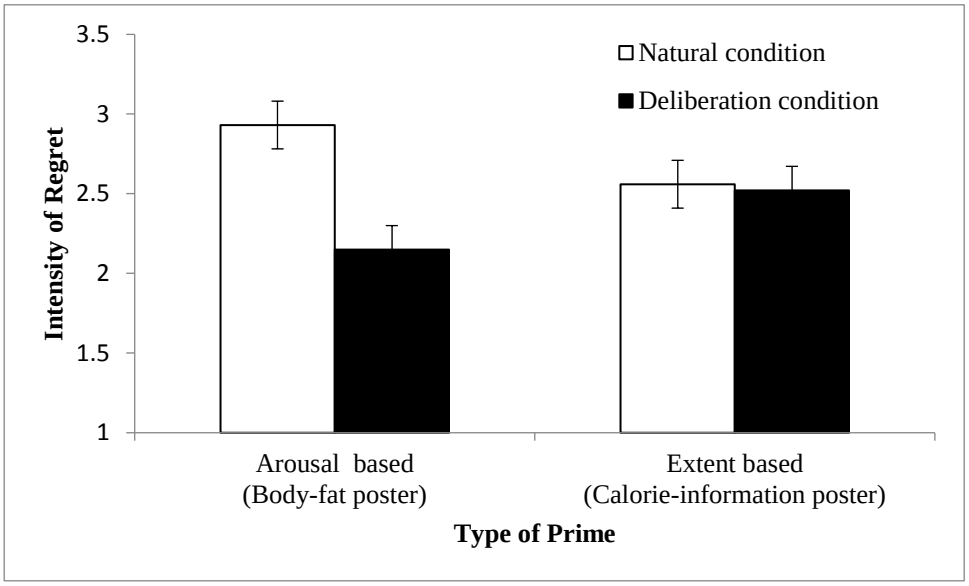
Two participants failed the instructional manipulation check and another participant was an outlier on response time; responses from these three participants were not included in the analysis. This data exclusion was done to reduce the effect of idiosyncratic participants. The results of analyses without the exclusion are provided in the Appendix 3B.

Consumption Regret

Reported regret was submitted to a 2 (evaluation mode: natural vs. deliberative) x 2 (prime type: affect based (body-fat poster) vs. extent based (calorie-information poster)) x 3 (food category: burgers & pizzas, fried food, and desserts) mixed model ANCOVA with evaluation mode and prime type as between-subjects factors and food category as a within-subjects factor. Participants' BMI was entered as a covariate in the model. There was a significant main effect of evaluation mode. Replicating the results from previous studies, reported regret was higher in the natural

mode condition than in the deliberative mode condition ($M_{natural}$ = 2.75, $M_{deliberative}$ = 2.34), $F(1, 184) = 7.66$, $p < .01$. More important, there was a significant interaction of evaluation mode and prime type, $F(1, 184) = 6.32$, $p = .01$. We conducted planned contrast analyses to probe this interaction. When participants were primed with the calorie-information poster, there was no discrepancy between the regret intensity in the natural mode and in the deliberative mode, suggesting that priming extent evaluation mitigated extent neglect ($M_{natural}$ = 2.56, $M_{deliberative}$ = 2.52), $F(1, 184) = 0.03$, $p > .85$. This result is consistent with our prediction that merely increasing the salience of extent evaluation without forcing participants to deliberate on their consumption extent will mitigate extent neglect. In contrast, when participants were primed with the affect-inducing body-fat poster, reported regret was higher in the natural mode than in the deliberative mode ($M_{natural}$ = 2.93, $M_{deliberative}$ = 2.15), $F(1, 184) = 14.17$, $p < .001$. This result is consistent with our prediction that when both deliberative extent evaluation and affective evaluation are salient and accessible, the evaluation of regret would be largely informed by deliberative extent evaluation because it is perceived to be more diagnostic than affective evaluation. Figure 3 graphically depicts the average intensity of regret in the four conditions. There was a main effect of food category, $F(2, 370) = 10.99$, $p < .001$, but there was no significant interaction between food category and other factors, ps > .18.

Figure 3: Priming Consumption Extent Reduces Extent Neglect (Study 3)



Manipulation Check

As expected, participants who saw the calorie-information poster rated the poster to be more quantitative (i.e., less emotional) than participants who saw the arousal-inducing fat-picture poster ($M_{calories\text{-}poster}$ = 5.98, $M_{body\text{-}fat\text{-}poster}$ = 3.39), F(1, 184) = 133.70, p < .001. Evaluation mode did not influence the ratings of the posters, F(1, 184) = 0.40, p > .52. There was an unexpected interaction of prime type and evaluation mode on the perception of the posters, F(1, 184) = 4.21, p < .05; the ratings of the two posters were farther apart for participants in the extent salient condition who estimated their calorie consumption, ($M_{calories\text{-}poster}$ = 6.28, $M_{body\text{-}fat\text{-}poster}$ = 3.23), F(1, 184) = 91.24, p < .001, than those in the natural condition who did not estimate their calorie consumption ($M_{calories\text{-}poster}$ = 5.68, $M_{body\text{-}fat\text{-}poster}$ = 3.55), F(1, 184) = 45.95, p < .001.

Confound Checks

There was no effect of evaluation mode, prime type, or the interaction of the two on participants' mood (*p*s > .23). The four involvement measures were highly correlated (α = .95) so we computed the mean of the four items to come up with a composite measure of involvement. There was no effect of evaluation mode, prime type, or the interaction of the two on the composite measure of involvement (*p*'s > .21).

Discussion

Participants in this study were exposed to one of two different advertising messages, one that primes affective evaluation or one that primes deliberative extent evaluation. Consistent with our account, priming extent to make it more salient mitigated the extent neglect. Furthermore, even when affective evaluation was primed, when participants were asked to deliberate on the extent of their consumption, the evaluated consumption regret was lower. These results again show that spontaneous affective reaction is more salient but deliberative extent evaluation is perceived to be more diagnostic. In our next study, we test whether we can increase the perceived diagnosticity of affective evaluation.

Study 4: Contextual Cues Can Increase Diagnosticity of Affective Evaluation

The studies thus far established two guiding principles of how affect and cognition interact in the experience of consumption regret: First, people naturally rely

on bodily arousal while neglecting deliberative extent evaluation because arousal is more salient than extent evaluation. Second, when the salience of extent evaluation is increased, people do rely on extent evaluation because it is perceived to be more diagnostic than arousal. In this study, we further explore the pivotal role of perceived diagnosticity in the interaction of affect and cognition in the experience of regret. Can contextual cues that increase the diagnosticity of arousal-driven affective evaluation make people rely on arousal and neglect consumption extent when both are salient?

Although extent evaluation is generally considered more diagnostic than arousal-based affective evaluations, it is not the case that extent evaluation will always trump affective evaluation. Because perceived diagnosticity is a heuristic assessment, when contextual cues increase the perceived diagnosticity of affective evaluation, it can direct the focus of attention to affective evaluation. This study tests this prediction. We increased the diagnosticity of affective evaluation using contextual cues that highlight the unhealthiness of the food items considered for consumption regret evaluation. First, we induced negative arousal in all participants. Then, for half of the participants we increased the perceived diagnosticity of the negative arousal through contextual comparisons.

Method

Participants and Design

The experiment was administered as an internet-based study to participants recruited from an online panel. Two hundred participants (113 women; average age:

33.9) completed the study for a small amount of money. The study used a 2 (evaluation mode: natural vs. deliberative) x 2 (perceived diagnosticity of affective evaluation: low vs. high) x 3 (food category: burgers & pizzas, fried food, and desserts) mixed factorial experimental design with evaluation mode and perceived diagnosticity of affective evaluation as between-subjects factors and food category as a within-subjects factor.

Procedure

Participants were randomly assigned to one of the four between-subjects conditions created by crossing evaluation mode and perceived diagnosticity of affective evaluation. To ensure that participants in all conditions are equally aroused, we presented all participants the same body-fat stimulus used in study 3. We then manipulated the perceived diagnosticity of this arousal. Half of the participants randomly assigned to the low perceived diagnosticity of affective evaluation condition reported how much they regret their consumption of unhealthy food items in three categories: burgers & pizzas, fried food, and desserts. The other half, assigned to the high perceived diagnosticity of affective evaluation condition, reported how much they regret their consumption of the unhealthy items as well as three healthy items: salads, fruits, and vegetables. We anticipated that direct comparisons of the evaluations of unhealthy items and the healthy items would make the arousal-based affective evaluation of these items to seem more diagnostic. This increased diagnosticity of affective evaluation, in turn, was predicted to make participants rely on arousal even when they deliberate on consumption extent and experience higher regret.

As in the previous study, extent salience was manipulated by asking participants to estimate consumption calories. Before evaluating their consumption regret, participants assigned to the deliberative evaluation condition were first asked to estimate, for each food category, how many calories they consume per month. Appendix 4A presents details of the stimuli used in this study.

Results

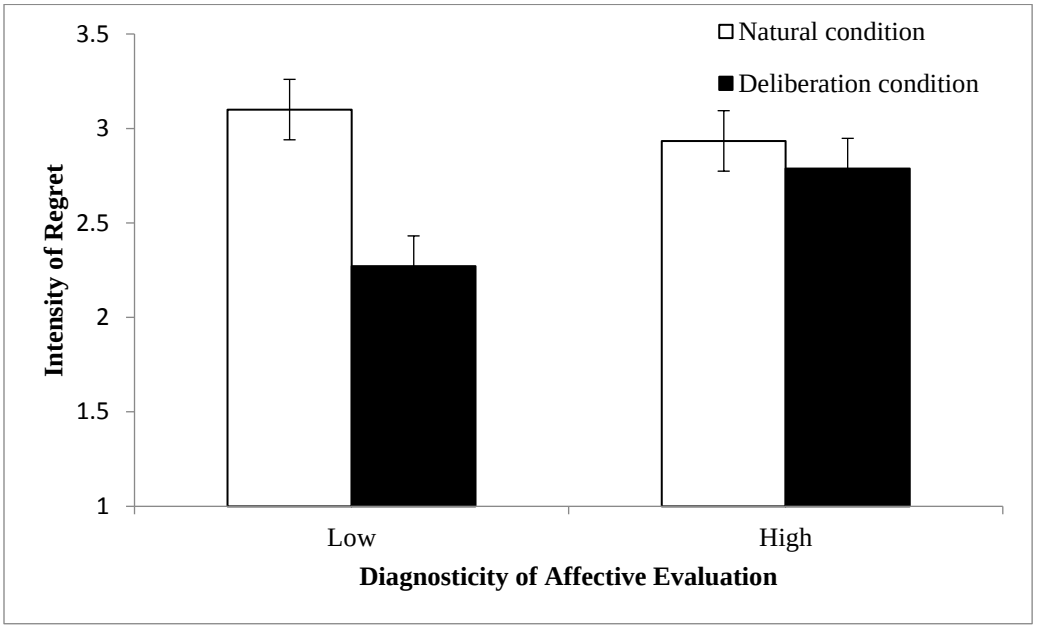
We excluded responses from twelve participants who failed the instructional manipulation check question at the end of the study. In addition, we excluded responses from one participant whose log-transformed completion time was more than three standard deviations away from the mean. Thus, the following results are based on the responses from remaining 187 participants. This data exclusion was done to reduce the effect of idiosyncratic participants. The results of analyses without the exclusion are provided in the Appendix 4B.

Consumption Regret

Reported regret was submitted to a 2 (evaluation mode: natural vs. deliberative) x 2 (perceived diagnosticity of affective evaluation: low vs. high) x 3 (food category: burgers & pizzas, fried food, and desserts) mixed model ANCOVA with evaluation mode and perceived diagnosticity of affective evaluation as between-subjects factors and food category as a within-subjects factor. Participants' BMI was entered as a covariate in the model. There was a significant main effect of evaluation mode. Reported regret was higher in the natural mode than in the deliberative mode

($M_{natural}$ = 3.02, $M_{deliberative}$ = 2.53), $F(1, 182) = 9.84$, $p < .01$. More important, there was a significant interaction of evaluation mode and perceived diagnosticity of affective evaluation, $F(1, 182) = 4.79$, $p < .05$. We conducted planned contrast analyses to probe this interaction. Replicating the results from study 3, when perceived diagnosticity of affective evaluation was low, regret reported in the natural mode was higher than regret reported in the deliberative mode ($M_{natural\text{-}low}$ = 3.10, $M_{deliberative\text{-}low}$ = 2.27, $F(1, 182) = 14.39$, $p < .001$. However, regret reported in the natural mode and that in the deliberative mode were not different when the perceived diagnosticity of affective evaluation was high ($M_{natural\text{-}high}$= 2.93, $M_{deliberative\text{-}high}$= 2.79), $F(1, 182) = 0.44$, $p > .51$. Figure 4 graphically depicts the pattern of reported regret in the four conditions. There was a main effect of food category, $F(2, 366) = 32.77$, $p < .001$, but there was no significant interaction between food category and other factors, ps > .51.

Figure 4: Increasing the Perceived Diagnosticity of Affective Evaluation Prevents Arousal Neglect Even When Consumption Extent is Salient (Study 4)



Confound Checks

There was an unexpected main effect of evaluation mode on participants' mood ($M_{natural}$ = 5.40, $M_{deliberative}$ = 5.75), $F(1, 182) = 6.46$, $p = .01$, but controlling for mood did not change our main results. There was no main effect or interaction effect of perceived diagnosticity of affective evaluation on mood (*p*s > .40). The four involvement measures were highly correlated (α = .96) so we computed the mean of the four items to come up with a composite measure of involvement. There was no effect of evaluation mode, perceived diagnosticity of affective evaluation, or the interaction of the two on the composite measure of involvement (*p*'s > .59).

Discussion

In the previous experiment (study 3), we reduced extent neglect by increasing the salience of extent evaluation. In this study, we reduced arousal neglect when extent was salient by increasing the diagnosticity of affective evaluation. This study shows that, even when extent information is salient, increasing the perceived diagnosticity of affective evaluation can prevent arousal neglect. We first induced negative arousal in all participants. Then we asked some participants to evaluate both healthy and unhealthy food items to increase the perceived diagnosticity of arousal-based affective evaluation. The comparison of healthy and unhealthy food item validated the diagnostic value of their negative feelings. Other participants did not make this comparison. When the perceived diagnosticity of affective evaluation was high, consumption regret remained relatively high even when they were prompted to consider their consumption extent. This result is consistent with our account that perceived diagnosticity is a heuristic assessment of the necessity and the sufficiency of the informational input to make the judgment and contextual cues that influence the subjective assessment of diagnosticities of these evaluations can determine whether regret is informed by arousal or deliberation.

General Discussion

This research challenges the characterization of regret as a cognitive construct that stems from higher order cognition and sheds light on the interaction of the affect and cognition in the experience of regret. Specifically, the results from four studies in

the context of consumption regret evaluation show that unless directed otherwise, there is a natural tendency to rely on spontaneous bodily arousal to evaluate consumption regret while not engaging in deliberative evaluation of consumption extent. The studies also show that because deliberative evaluation of consumption extent is perceived to be more diagnostic than arousal, when it is made salient, people do rely on the deliberative evaluation while relying less on arousal. Using skin conductance measures, study 1 directly shows that natural evaluation of consumption regret is influenced largely by spontaneous bodily arousal and that deliberating on consumption extent reduces attention to this arousal. Study 2 provides direct evidence that people attend to deliberative evaluation of consumption extent only when they are asked to. Study 3 and study 4 show that contextual cues can be used to manipulate the pattern of interaction of affective and cognitive inputs in the evaluation of consumption regret.

Across studies, the intensity of experienced regret was higher when participants reported regret without deliberating on the extent of their consumption. The pattern of extent neglect in study 2 shows that the discrepancy is driven largely by participants who believe their consumption extent to be reasonably low. That is, while deliberative evaluation allows people who consume reasonably low quantities to evaluate their consumption regret to be accordingly low, failure to do so in the natural mode of evaluation causes consumption regret to be higher in this mode. These results suggest that at least for some consumers who have prudent eating habits, the consumption regret or food guilt they experience might be unwarranted because of the natural tendency to neglect consumption extent during the evaluation of consumption

regret. However, our conceptualization does not suggest that extent neglect will always mitigate consumption regret; in situations where consumption extent is unjustifiably high, regret evaluated after deliberating on consumption extent could be higher than naturally experienced consumption regret.

In addition to contributing to the literature on regret, our research also contributes to the studies of the somatic marker hypothesis (Bechara and Damasio 2005; Damasio 1994; 1996). Whereas majority of the studies testing the somatic marker hypothesis compared the behavior of brain lesion patients incapable of experiencing emotion and control participants who are capable of experiencing emotions, the current research extends the testing of the hypothesis using only the participants who are capable of experiencing emotions. Our results show that while emotions experienced in the body proper (arousal) can be used as an important input in the experience of conscious feeling (consumption regret), it is not always the case when there is another input that is perceived to be more diagnostic (deliberative evaluation of consumption extent) in the appraisal of the feeling.

This research also provides some insight into the debate on the beneficial effects of consumption quantification. Some researchers observed beneficial impact of consumption quantification (Bassett et al. 2008; Burton et al. 2006; Dumanovsky, et al. 2010; Wisdom, Downs, Loewenstein 2010) whereas others didn't (Downs, Loewenstein, Wisdom 2009; Elbel et al. 2009). Our results suggest that consumption quantification can sometimes reduce consumption regret and make the consumption seem justifiable. This is particularly true for infrequently considered items such as fried donuts and burgers. While people know that these items are unhealthy, bringing

to mind the consumption quantity (e.g., "I eat only once or twice a week") can make the consumption seem justifiable and prevent behavior remediation.

The findings from the current research also have implications for advertising messages created to curb overconsumption. Some public service organizations and government agencies use affective, visceral stimuli to change consumption behaviors. Other agencies tend to use more deliberative messages; the "Let's Move" advertisement that we used in study 4 was adapted from the former first lady Michelle Obama's campaign. Our results suggest that because people neglect extent while evaluating their behaviors, visceral images are more likely to cause consumption regret and behavior remediation.

While this paper focuses on evaluations of regrettable behaviors and how extent neglect could cause unwarranted negative emotional experiences, similar pattern of interaction between affect and cognition could also cause unwarranted positive emotional experiences in different contexts. Think of a dieter who evaluates her diet progress largely by focusing on whether she lost her weight rather than on how much weight she lost. Similarly, the dieter could evaluate her exercising behavior by focusing largely on whether she went to the gym rather than focusing on how much calories she burnt at the gym. Extent neglect in these contexts could cause unwarranted pride or satisfaction which could subsequently lead to unwarranted self-rewarding or licensing. Similarly, evaluating how balanced a meal is by focusing on whether there are healthy food items on the plate without considering how much of the healthy items are on the plate could be harmful for one's health. A student who evaluates his productivity largely by considering whether he spent some time sitting at

a desk rather than considering how much progress he's made on his final paper might reward himself with unwarranted night out at a club. We believe that delineating the interplay of affective and cognitive aspects of different emotions could be a fruitful path for future research.

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PAPER 2: ELECTRODERMAL RESPONSES TO MODE OF PAYMENT: THE SOMATIC MARKER HYPOTHESIS

For the past several centuries, cash was the dominant form of payment. People used to carry currency bills and coins with them to pay for their transactions. In the last three decades, the form of payment has undergone a major transformation. Now a majority of retail transactions are carried out through card payments (Nilson Report 2007). Although sellers and buyers both have welcomed the cashless economic environment, an emerging stream of research has identified an unintended consequence of cashless payments: it can increase spending. Results from several studies suggest that paying with credit card or debit card can increase spending compared to paying with cash (Hirschman 1979; Feinberg 1986; Prelec and Simester 2001; Soman 2001; Raghubir and Srivastava 2008). Moreover, recent studies have qualified these results by showing that the propensity to overspend with credit card or debit card is more prominent for impulsive purchase decisions. Relative to card payments, cash payments decrease impulsive purchases of tempting but less healthy food items such as muffins, cookies, and French fries. For example, Just and Wansink (2014) found that schools that allowed students to use only cash payments to pay for their lunch had lower consumption of candies and higher consumption of fruits and vegetables compared to schools where card payments were accepted at the cafeteria. Soman (2003) analyzed the shopping baskets of people who had just completed their shopping and found that when shoppers paid in cash, their shopping baskets had a smaller proportion of treats/luxuries (e.g., chocolate, gum, snacks) relative to those

who paid using cards. Thomas, Desai, and Seenivasan (2011), in addition to finding the same pattern from their analysis of the real life shopping behavior of a large number of households, replicated these results in laboratory experiments by showing that participants' shopping baskets had a smaller proportion of vice products when participants imagined paying using cash than when they imagined paying using credit card. The external validity of these findings is corroborated by an alarming correlation between the increase in obesity and the increase in the availability of plastic payments in the past two decades (Humphrey 2004; Ogden et al. 2006; Nilson Report 2007).

Although the effect of mode of payment on impulse control is now well-documented in the literature, the psychological mechanism underlying the effect remains relatively unclear. It is generally assumed that people spend more on debit or credit card because they have more money to spend and that they don't monitor their spending carefully relative to when they spend cash. Several scholars have challenged this explanation and have argued that the actual psychological process entails changes in emotional responses. They have suggested that cash payments increase the "pain of paying" – a learned emotional response to parting with money (Prelec and Loewenstein 1998; Prelec and Simester 2001; Soman 2003; Raghubir and Srivastava 2008; Rick, Cryder, and Loewenstein 2008; Thomas et al. 2011). Although, the assumption that cash payments can cause emotional responses that influence decisions is implicitly or explicitly endorsed by many scholars, this assumption has never been empirically tested. The first purpose of this research is to test this pivotal assumption about the role of emotional responses in mode of payment effects. Does mode of payment actually change emotional responses? Can these changes be measured using

physiological correlates of emotions that do not rely on self-reports? The second purpose is to explain how emotional responses evoked by cash payments influence purchase decisions. How does the proposed change in emotional state influence regulation of impulsive purchases? To explain the role of emotional responses in mode of payment effects, we bring together two distinct streams of literature, the literature on somatic markers (Damasio 1996; Bechara et al. 1999; Bechara, Tranel, and Damasio 2000; Tranel, Bechara, and Denburg 2002) and that on pain of paying (Prelec and Loewenstein 1998; Prelec and Simester 2001). The gist of our proposal is that pain of paying is a learned somatic marker of decision conflict and the activation of these somatic markers help regulate impulsive responses.

To demonstrate the role of emotional responses in the impulse regulation effect of mode of payment using somatic marker hypothesis, we manipulate the mode of payment in a simulated shopping task and measure participants' electrodermal activity (EDA) or skin conductance. We test whether mode of payment – cash versus card – changes participants' EDA when they make shopping decisions. Furthermore, we also test whether the effect of mode of payment on EDA is contingent on the nature of the product being considered. To presage our results, we find that participants' anticipatory EDA levels are higher in the cash payment condition than in the card payment condition and this effect is stronger under conditions of decision conflict when people considered tempting but unhealthy vice items. The results suggest that the EDA evoked by cash payments serves as a somatic marker that identifies decision conflict. By demonstrating the effect of payment mode on people's bodily responses and the effect of the bodily responses on impulse regulation, our results show that

emotion plays a critical role in the mode of payment effect.

Conceptual Framework

Somatic markers are bodily changes – such as heart rate, sweat gland activity, and facial expressions – that become associated with particular situations and their outcomes. These changes in body and brain states can be covert (unconscious) or overt (conscious), manifesting as emotional experiences. They play an important role in guiding judgment and decision-making. In the following sections, we will first review evidence from studies showing that somatic markers can influence decisions. Then we will characterize the role of somatic markers in the mode of payment effect to explain how the bodily response to cash payment curbs impulsive purchase.

Somatic Markers Guide Decision Making

Neuroscientists proposed the somatic marker hypothesis to explain the paradoxical behaviors of patients with lesions in the ventromedial prefrontal cortex. These patients showed no signs of cognitive impairments; they performed well in intelligence tests, memory tests, and knowledge tests. Their basic attentional processes were intact. Yet they had difficulty in long-term planning and often made choices that resulted in financial or social losses. That is, despite retaining their cognitive functioning, patients with lesions in the ventromedial prefrontal cortex lost the ability to make choices that maximized their long-term advantages. Damasio (1996) and

other researchers (Bechara et al. 1994) suggested that human reasoning and decision making are not only influenced by explicit knowledge represented as facts, rules, stories, and mental images, but also by innate knowledge represented as emotional experiences, somatic markers, and action propensities. As noted previously, emotional experiences are accompanied by changes in bodily states – such as heart rate, sweat gland activity, and facial expressions – that these neuroscientists referred to as somatic markers of the emotional state. Although brain lesions do not impair cognitive functions and explicit knowledge, these lesions can prevent people from experiencing the activation of somatic markers that guide decision makers through conflicting choices. These are some of the basic assumptions underlying the somatic marker hypothesis.

Empirical evidence for the claim that somatic markers guide decision-making comes from the studies examining the performance of patients with brain lesions in the Iowa Gambling Task (Bechara et al. 1994). In Iowa Gambling Task, participants – normal people and those with brain lesions – are asked to draw cards from four decks of cards that could either lead to gain or loss. Participants earn a reward after each draw. However, some of the draws also come with a penalty. Participants are given the goal of maximizing their profits by choosing cards judiciously from the four decks, one card at a time from any deck of their choice. Unbeknownst to the participants, two of the decks are designed to offer high immediate gains but larger future losses, while the other two decks are designed to offer lower immediate gains but smaller future losses. Specifically, each draw from deck A or deck B yields $100 whereas each draw from deck C or deck D yields $50. Thus, deck A and B offer larger immediate gains.

However, the cards in deck A and B also come with larger penalties than cards in deck C and deck D: ten draws from deck A or B incurs penalty of $1250 while ten draws from deck C or D incurs penalty of only $250. Thus, on average in the long run, a draw from deck A or B incurs a net loss of $25 while a draw from deck C or D yields a net gain of $25. In the early stages of the gambling task, participants tend to choose more cards from the decks A or B that offers high immediate gains but larger future losses. However, over time they learn the implicit rule that it is more advantageous to switch to the decks C or D that provides lower immediate gain but smaller future loss. The results from a series of studies show that while normal control participants switched to the advantageous decks that maximize their long-term gains, participants with brain lesions failed to make the switch to the advantageous decks and ended up performing poorly in the gambling task. Such disadvantageous decision-making by the patients with brain damage in the Iowa Gambling Task has been attributed to the absence of somatic marker activation in the anticipation and experience of disadvantageous outcomes (Damasio 1996; Bechara et al. 1999; Bechara et al. 2000; Tranel et al. 2002).

The analysis of the skin conductance activity during the participation in Iowa Gambling Task showed that the absence of anticipatory skin conductance response was a marker of disadvantageous decisions. Skin conductance response varies with the activation levels of the sweat glands on the skin. Sweat glands are activated by the sympathetic nervous system, and greater sweating which manifests as higher skin conductance is an indication of greater arousal (Bouscein 1992; Dawson, Schell, Filion 2007). After playing a few rounds of the game, normal participants began to

show higher skin conductance response whenever they considered making a selection from a bad deck (deck A or deck B). However, there were no such skin conductance response spikes when they were about to draw a card from a good deck (deck C or deck D). This suggests that somatic markers identify conflicting decisions, in this case, the conflict between larger immediate gain and larger potential loss, that call for caution and vigilance. More importantly, for patients with brain lesions, bad decks did not trigger higher skin conductance (Bechara et al. 1999; Tranel et al. 2002). The absence of somatic markers among the patients with brain lesions prevented them from identifying and avoiding the disadvantageous decks of cards. Results from these studies suggest that somatic markers or bodily signals play an important role in identifying disadvantageous decisions. Furthermore, somatic markers seem to operate by identifying situations that are characterized by decision conflict.

Somatic Markers and Mode of Payment

We propose that somatic markers play a role in the mode of payment effect. Much like the way the learned negativity of a bad deck activated somatic markers in the participants of Bechara et al.'s (1999) and Tranel et al.'s (2002) Iowa Gambling studies, learned negativity of cash payment can also activates somatic markers in consumers. Parting with cash is usually a painful experience. During the process of socialization, even as children, people learn to conserve their wealth. They develop an autonomic response to identify situations that might result in a loss of wealth. Because of this learned response, even the imagery of opening one's wallet and giving out

one's hard earned cash can evoke an autonomic visceral response. As noted previously, this emotional response to parting with money has been referred to as the pain of paying (Prelec and Loewenstein 1998; Prelec and Simester 2001; Soman 2001; Raghubir and Srivastava 2008; Rick, Cryder, and Loewenstein 2008). The extant research suggests that the pain of paying with cash payments is stronger than the pain of paying with card because card payments are more abstract and less concrete. In the case of card payments, the mental coupling between the mode of payment and the experienced pain is relatively weak presumably because the depletion of the wealth happens in a distant bank account at a distant point in time. Therefore, people do not experience the same visceral response when they pay using cards. The primary objective of the present research is to test the hypothesis that the pain of paying serves as a somatic marker and will therefore manifest as an increase in EDA when people make purchasing decisions. We hypothesize that while making purchasing decisions, those paying with cash would experience a higher spike in the EDA relative to those paying with more abstract form of payment such as credit card.

The Role of Decision Conflict

The activation of somatic markers is a learned bodily reaction that guides people to advantageous decision making that is more likely to be prominent when the decision process introduces decision conflict. This was the case in the studies by Bechara et al. (1999) and Tranel et al. (2002) wherein normal participants without brain lesions experienced stronger anticipatory skin conductance reaction towards the

decks that introduced a decision conflict between short-term gain and long-term loss (decks A & B). There was no such skin conductance reaction towards decks that did not pose such conflict (decks C & D). Extending this idea to the context of purchase decisions, somatic marker activation is more likely to be prominent when people consider purchases that are characterized by conflicting feelings of desirability on the one had ("go" signals) and anticipated regret and guilt on the other hand ("stop" signals). For example, when a shopper reaches out to buy a gallon of her regular brand of milk, or when she picks up a pack of her usual laundry detergent, it will not activate somatic markers because the purchase decision does not evoke conflicting responses. However, when she encounters a product that elicits conflicting responses – for example, when she is considering the purchase of a family pack of sugar laden cookies or ordering a side of fat laden French fries – she is likely to vacillate in her decision making. The somatic marker hypothesis suggests that the activation of somatic markers is more likely when consumers consider such vice items that introduce the conflict between short-term pleasure and long-term negative effects on health. Furthermore, somatic marker hypothesis suggests that the activated somatic markers, as they guided the participants in Iowa Gambling task to make more sound decisions in the long run by avoiding the risky decks, will guide consumers to make more advantageous decisions by giving up the short-term pleasure of cookies or French fries for the sake of long term health benefit. Thus, we predict the somatic marker activation induced by cash payments, measured with the level of EDA, to be more pronounced for vice food products that elicit decision conflict than for virtue food products. Furthermore, as the activation of somatic markers is a learned bodily

reaction guiding people to make advantageous decisions, reliance on the activated somatic markers should also be more pronounced in the presence of decision conflict. Therefore, we predict the impulse controlling effect of EDA on purchase decision to be stronger for vice food products than for virtue food products. We hypothesize that the effect of mode of payment on EDA is stronger for vice products that elicit greater decision conflict and that the effect of EDA on purchase decision is stronger for products that elicit greater decision conflict.

To test these hypotheses, we designed a simulated shopping task following the procedure used in prior studies. Our experiment aims to replicate the mode of payment effect and tests the proposed role of somatic markers by examining participants' EDA activity during the shopping task.

Methodological Considerations

Before we proceed to describe the experiment, it might be useful to alert the readers to a couple of methodological challenges in using EDA data. First, there is the question whether somatic markers should be measured by tracking skin conductance response (SCR) or overall EDA level. SCR includes only the phasic change in EDA (i.e., deviations from the baseline EDA for each participant). Overall EDA level, in contrast, includes the tonic as well as phasic level of skin conductivity of the skin. Both of these measures have been used in the extant literature as a measure of skin conductance reactivity. Changes in overall EDA level are relatively larger and easier to detect (1 to 3 microseimens) whereas changes in SCR are much smaller and more

difficult to detect (0.1 to 1 microseimens). Furthermore, since SCRs take around three seconds to reach its peak amplitude, it is almost impossible to use SCR for decisions that take less than three seconds (see Dawson, Schell, Filion 2007 for a detailed discussion on these aspects of EDA data). Because of these considerations, we decided to use overall EDA level rather than SCR. This approach is consistent with the approach in several studies on judgment and decision making (Aaker, Stayman, and Hagerty 1986; Groeppel-Klein 2005; Ohme et al. 2009).

Second, there is considerable heterogeneity in participants' EDA reaction to different products. A given product does not elicit the same arousal in all participants; there is considerable variance across products and individuals. To overcome this issue, we use a repeated-measurement design wherein we use several replicates in each product category and then aggregate the EDA measures across these replicates to test which category elicits higher EDA. The idea is that when we measure EDA across multiple replicates in each category, we can compare the differences in EDA caused by category effects after controlling for the idiosyncratic effects of the products. In addition, since the different food items are presented in a random order, it should also be noted that relatively large variances in EDA are caused by the differences in the order of presentation or habituation effect (can be as high as 5 microseimens). Compared to the habituation effect, the effect of category is likely to be very small (around 1 microseimens). Therefore, the modeling challenge is to estimate the effect of the category after controlling for individual-level heterogeneity in the ordering (i.e., habituation) effect of the shopping items presented. We adopted a mixed-effect modeling approach, treating habituation as a random effect, to address this issue.

Experiment

This experiment was designed to demonstrate the role of somatic markers in the mode of payment effect. Participants were asked to respond to a simulated shopping task. Somatic marker activation was tracked by measuring participants' EDA during the shopping task. The experiment used a 2 x 2 mixed factorial design: mode of payment (card vs. cash) was manipulated between participants and type of products (vice vs. virtue) was manipulated within participants. There were 15 replicates of vice as well as virtue products. Additionally, we also measured participants' self-reported dietary restraint goals using a validated scale (van Strien et al. 1986) to examine how diet control goals influenced shopping decisions and EDA.

Method

Participants

One hundred and four students from a US university (65% female, average age 20.7) participated in this experiment and were paid $5 for their participation.

Apparatus

The experiment was administered on a desktop computer using Macromedia Authorware software. EDA (in microSeimens; μS) was measured using BIOPAC System's Bionomadix device that uses a 0.5 V constant voltage excitation and recorded using the AcqKnowledge software. After each participant completed the

study, the research assistants saved the participant's EDA data, which was later merged with the output file from Macromedia Authorware used to collect participants' self-reported responses.

Procedure

The experiment was administered to one participant at a time (over a period of 20 days) by three trained research assistants in a small room equipped with a one-way mirror. The one-way mirror enabled the research assistants to observe the participants without being present in the room. When participants reported to the lab, they were seated before a computer and informed that they would have to respond to a computer-based shopping study. Further, they were told that the researchers are interested in measuring their skin conductance levels during the study. At this point, the research assistants helped the participants put on the EDA measurement device on their non-dominant hand (so that they could freely use their dominant hand to operate the mouse). All participants indicated they use their right hand to operate the mouse so they put on the EDA measurement device on their left hand. Two silver-silver chloride electrodes (Ag-AgCl) pre-gelled with isotonic gel by the manufacturer were attached to the thenar and hypothenar eminences of the participant's palm (Dawson et al. 2007). The research assistants ensured that participants' palms were clean and dry before putting on the sensors. Furthermore, the participants were told that the sensors should remain on their palms during the entire course of the study. Right before the participants' started responding to the task, the research assistants exited the room and observed the participants' through the one way mirror. The main task – shopping decisions – was preceded by a stabilization phase.

Stabilization Phase

It takes some time for participants to get used to the sensors attached to their palms. Additionally, EDA takes some time to stabilize. To allow for these stabilization processes, after the sensors were attached to the participants' palms, they were asked to wait for a minute and complete some tasks that are unrelated to the study. During this phase, participants were shown 36 dictionary words and artificial non-words, and were asked to read aloud each of them and rate how easy or difficult it is to pronounce it. On average, this task took around 6 minutes.

Shopping Study

The shopping study commenced after the stabilization phase. The shopping study was presented in the guise of a market research study. Participants read that a large retail chain is considering opening a store in their city and wants to study the residents' food preferences. The manipulation was administered before they started the shopping. The computer randomly assigned participants into either the card condition or the cash condition. Those assigned to the card condition saw a picture with the logo of four popular cards accompanied by the statement: "The store accepts all major credit and debit cards." Those assigned to the cash condition saw a picture of dollar bills and were informed that the store accepts cash payments only. The two screens are depicted in Appendix 5. These screens remained on the computer for 60 seconds in the respective conditions. Thereafter, all participants saw 30 food items – 15 vice and 15 virtue – one at a time. The vice and virtue products were interspersed and the order of presentation of the 30 products was randomized by the computer for each participant. For each product, the participants saw on the screen a picture of the product, its name

and price. They had to indicate their purchase decision for that product by clicking on one of the two buttons – "Add to Shopping Cart" or "Continue Shopping." Appendix 6 depicts some examples. The average of EDA level measured while participants were making their purchase decision for each product was later used for the analyses of how payment mode and type of product influenced EDA and how EDA subsequently influenced purchase decision. Each product was separated from the subsequent product by a blank screen with a "Continue" button at the center of the screen (see Appendix 6). Participants proceeded to the next product by clicking on the continue button; thus, the experiment was self-paced. Participants took an average of 2.04 seconds to make each purchasing decision.

Stimuli

The 30 products used as stimuli in the study were selected based on a pretest. Appendix 7 lists the vice and virtue products used in the experiment. Note that the vice products were rated to be more impulsive but less healthy than virtue products. Therefore, these products were expected to elicit greater decision conflict.

Attention to Price

Immediately after the simulated shopping task, participants were asked to estimate from memory how many items they added to the shopping cart and the total expense incurred in shopping. They typed in these estimates in separate text boxes on the screen. Since the participants could not go back to the previous screens, they had to estimate these measures from their memory. The accuracy of the estimated spending is used a measure of attention to the price of the product during the shopping task.

Manipulation Checks

Then participants were asked to recall which mode of payment the store accepts. They submitted their response by clicking on one of the two options – "cash only" or "card payments." Additionally, to measure participants' feeling associated with their spending, participants were asked to indicate how they felt about spending money on the shopping trip. Specifically, they read the following instruction: "A store's payment policy can influence how consumers feel on a shopping trip. How did you feel about spending money on this shopping trip?" Participants indicated their response on a 5-point unnumbered feelings scale which was anchored with the emoticon ☹ on the left-end and the emoticon ☺ on the right-end. The responses were coded such that higher scores on this scale indicate more negative feeling (i.e., greater pain of payment).

Healthfulness

Participants were asked to rate each of the 30 items on the perceived healthfulness of the product on a five-point scale anchored at -2 = "Unhealthy" and +2 = "Healthy."

Restrained Eating Scale

Then, participants completed the 10 item restrained eating scale (van Strien et al. 1986) to test whether the activation of somatic markers measured by EDA would be more pronounced for participants who are restrained eaters who presumably experience more decision conflict when deciding whether to purchase food items. This scale included questions such as "Do you try to eat less at mealtimes than you would like to eat?" and "Do you watch exactly what you eat?" Finally, they answered

questions about their frequency of consumption and demographic variables.

Results

Response Exclusion

During the analyses of the EDA data, it was observed that data from four participants were not recorded probably because the sensors were accidentally detached from their palms during the experiment. Therefore, the analyses are based on the responses from 100 participants.

Manipulation Checks

All participants cleared the manipulation check. Specifically, all participants in the cash condition correctly recalled at the end of the study that the store accepted cash payments only whereas all those in the card payment condition recalled that the store accepted all types of cards. Additionally, a one-way ANOVA revealed that participants in the cash condition had a more negative feeling (i.e., greater pain of payment) about spending money (M_{cash} = 3.06 vs. M_{card} = 2.08; $F(1, 98) = 23.74$, $p <$ .01). This result is consistent with our conceptualization.

EDA during Purchase Decisions

Participants' EDA was regressed on two main factors and their interaction terms: type of product and mode of payment. We applied a log transformation to the dependent variable given its distribution is right-skewed and has a positive support. To control for the differences in the order in which the food items were presented to each participant and the different rate at which each participant habituated during the

shopping task, we specified the order of presentation (*t*) as a random effect in the model after log-transforming the variable, in accordance to the log-transformation of the dependent variable. Using the lmer command (lmer4 package) in R, we estimated the following random-effects model:

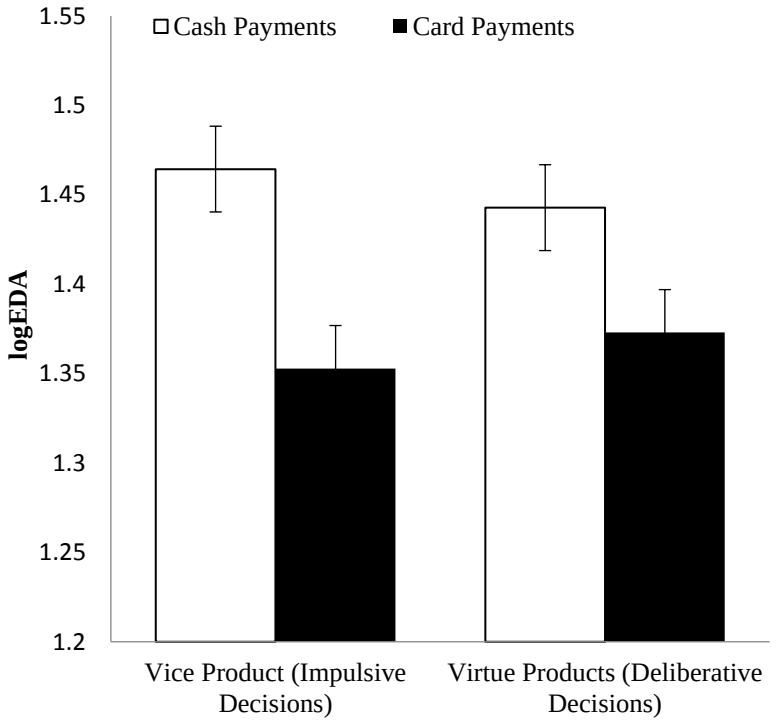
$$\log(EDA_{it}) = \beta_0 + \beta_1 Cash_i + \beta_2 Vice_{it} + \beta_3 Cash_i \cdot Vice_{it} + \alpha_i \log(t_i) + \epsilon_{it}$$

for participant *i* and shopping occasion *t*. The results are summarized in Table 1. The simple effect of type of mode of payment (Cash Payment) was significant, β = .070, $p < .05$, and the sign of the coefficient suggests that relative to participants in the card condition, participants in the cash condition experienced higher EDA during the shopping task. Furthermore, the two-way interaction between mode of payment (Cash Payment) and type of product (Vice Product) was significant, β = .042, $p < .05$, suggesting that the effect of cash payment that increases EDA relative to card payment during the shopping task was more pronounced for the vice products than for the virtue products. These results are consistent with our hypotheses that paying with cash (compared to paying with card) induces stronger visceral reactions, measured with anticipatory EDA, during purchasing decisions and this effect of mode of payment on EDA is stronger for vice products that elicit greater decision conflict. Figure 5 depicts the pattern of EDA as a function of mode of payment and food type.

Table 1: Paying with Cash (instead of Card) Increases Anticipatory EDA during the Shopping Task and this Effect is Stronger for Vice Products

	logEDA			logEDA		
	b	t-value	p-value	b	t-value	p-value
Intercept	1.373	56.868	< .001	1.359	56.596	< .001
Vice Product	-.020	-1.340	.180	-.024	-1.622	.105
Cash Payment	.070	2.063	.039	.099	2.938	.003
Vice Product x Cash Payment	.042	1.984	.047	.047	2.235	.025
Restrained Eating				.122	6.841	< .001
Vice Product x Restrained Eating				.007	.586	.558

Figure 5: Paying with Cash (instead of Card) Increases Anticipatory EDA during the Shopping Task and this Effect is Stronger for Vice Products



Furthermore, we conducted additional specifications of the model by including participants' restrained eating score and its interaction with food type as covariates. These results are also summarized in Table 1. Again, the simple effect of mode of payment (Cash Payment) was significant, $\beta = .099$, $p < .01$, and also the two-way interaction between mode of payment (Cash Payment) and type of product (Vice Product) was significant, $\beta = .047$, $p < .05$, suggesting that the key results were robust even after controlling for participants' restrained eating score. The result also shows that the higher the restrained eating score, the higher the EDA, $\beta = .122$, $p < .01$, suggesting that restrained eaters who presumably face more conflict when making

food purchase decisions experienced higher activation levels of somatic markers.

Purchase Decision

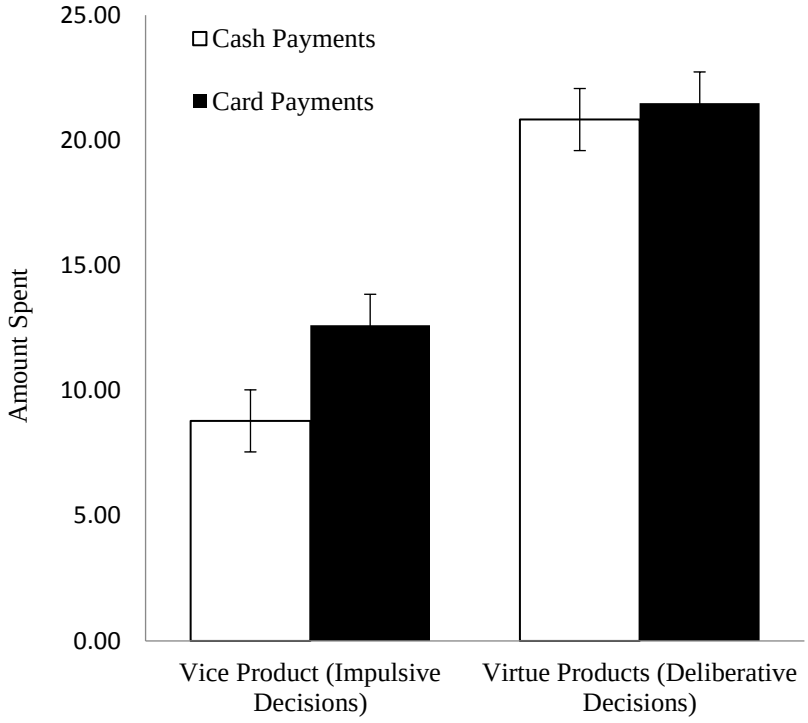
When participants added a product to the shopping cart, the response was coded as 1 and when they did not do so the response was coded as 0. Again, this binary variable was regressed on two main factors and their interaction terms: type of product and mode of payment. To control for individual heterogeneity in baseline purchase propensity, we use the glmer command (lme4 package) in R to estimate a random-intercept logistic regression. The results are summarized in Table 2. The simple effect of type of product (Vice Product) was significant, $\beta = -1.426$, $p < .01$, and the sign of the coefficient suggests that relative to virtue products, participants were less likely to purchase vice products. More importantly, the two-way interaction between mode of payment (Cash Payment) and type of product (Vice Product) was significant, $\beta = -.375$, $p < .05$, suggesting that cash payment, compared to card payment, reduced the propensity to buy vice products. This result is consistent with our conceptualization and replicates the findings from previous research (Soman 2003; Thomas et al. 2011; Just and Wansink 2014).

Table 2: Paying with Cash (instead of Card) Decreases the Likelihood of Purchasing Vice Products during the Shopping Task

	Purchase Decision (1)			Purchase Decision (2)		
	b	z-value	p-value	b	z-value	p-value
Intercept	.237	2.081	.038	.208	1.820	.069
Vice Product	-1.426	-12.045	< .001	-1.378	-11.571	< .001
Cash Payment	-.024	-.150	.881	.041	.253	.800
Vice Product x Cash Payment	-.375	-2.203	.028	-.490	-2.834	.005
Restrained Eating				.279	3.256	.001
Vice Product x Restrained Eating				-.437	-4.703	< .001

Participants in the card conditions purchased 30% more vice products than participants in the cash condition, $p < .05$. However, there was no difference in the odds ratio between the card condition and the cash condition for virtue products. To further corroborate this interaction, we computed the total value of vice and virtue products included in each shopping basket and examined how these values changed across cash and card conditions (see Figure 6). The total value of vice products included in their shopping cart was lower when participants were in the cash condition than in the card condition (M_{cash} = \$8.79 vs. M_{card} = \$12.61, $F(1, 95) = 4.76$, $p < .05$). However mode of payment did not change the value of virtue products in the basket, (M_{cash} = \$20.83 vs. M_{card} = \$21.49, $F(1, 95) = 0.14$, $p > .70$).

Figure 6: Paying with Cash (instead of Card) Decreases the Amount Spent on Vice Products



Furthermore, we conducted additional specifications of the model by including participants' restrained eating score and its interaction with food type as covariates. These results are also summarized in Table 2. Again, the simple effect of type of product (Vice Product) was significant, $\beta = -1.378$, $p < .01$, suggesting that participants were less likely to purchase vice products. Also, the two-way interaction between mode of payment (Cash Payment) and type of product (Vice Product) was significant, $\beta = -.490$, $p < .01$, suggesting that cash payment, compared to card payment, reduced the propensity to buy vice products. There was also a significant two-way interaction of restrained eating score and food type (Vice Product), $\beta = -.437$, $p < .01$, suggesting that the higher the restrained eating score, the less likely it is for

participants to purchase vice products.

Effect of EDA on Purchase Decision

To understand the effect of EDA on each purchase decision, the binary variable indicating whether participants purchased the product or not was regressed on log-transformed average EDA level measure during the purchase decision of the product, type of product, and the interaction of the two variables. The results are summarized in Table 3. There was a significant interaction of log-transformed EDA and type of product (Vice Product), $\beta = -.234$, $p < .05$, suggesting that the higher the EDA, the less likely it is for participants to purchase vice products. This result is consistent with our conceptualization (and Bechara et al.'s (1999) and Tranel et al.'s (2002) findings) that EDA is a somatic marker that guides people to make advantageous decisions under conditions of decision conflict. An increase in EDA did not affect the purchase of virtue products; it only affected the purchase of vice products that evoke decision conflict.

Table 3: The Higher the EDA, the Lower the Purchase Likelihood of Vice Products

	Purchase Decision		
	b	z-value	p-value
Intercept	.108	.705	.481
logEDA	.090	.897	.370
Vice Product x logEDA	-.234	-2.126	.034
Vice Product	-1.309	-7.990	< .001

Healthfulness Ratings

Participants' healthfulness ratings of the 30 products were regressed on two factors and their interaction term: type of product, mode of payment. Only the simple effect of type of product was significant at conventional levels, β = -3.06, $p < .01$. Predictably, participants considered vice products as less healthy. More importantly, the perceived healthfulness of neither vice products (M_{cash} = -1.66 vs. M_{card} = -1.61, $F(1, 98) = 1.48$, $p > .22$), nor virtue products was affected by mode of payment (M_{cash} = 1.38 vs. M_{card} = 1.40, $F(1, 98) = .29$, $p > .58$). Thus, mode of payment did not influence cognitive evaluations of products.

Attention to Price

To rule out the possibility that the effect of mode of payment was caused by inattention to price in the card payment condition, we examined participants' estimates of shopping basket. Table 4 lists the actual number of the items and values of items in the shopping basket along with participants' estimates. As is evident, participants in both conditions were quite accurate in recalling the total value of the products that they shopped. We computed the difference between estimated amounts and the actual amounts (which served as a measures of recall accuracy) and submitted it to a one-way ANOVA with mode of payment as the predictor. Mode of payment neither affected recall accuracy of the number of items ($p > .40$) nor the accuracy of the value of items included in the shopping basket ($p > .51$). These results suggest that the observed effect of mode of payment cannot be attributed to inattention to prices.

Table 4: Mode of Payment Did Not Influence Participants' Attention to Price during the Shopping Task

	Card Payments		Cash Payments	
	Actual	Estimate	Actual	Estimate
No. of Items Purchased	12.06	10.02	11.08	9.37
Value of Items	$34.10	$35.56	$29.62	$31.82

General Discussion

The current research contributes to the literature on mode of payment by demonstrating the role of bodily responses in explaining the impulse control effect of cash payment. We bring together the literature on somatic markers (Damasio 1996; Bechara et al. 1999; Bechara, Tranel, and Damasio 2000; Tranel, Bechara, and Denburg 2002) and that on pain of paying (Prelec and Loewenstein 1998; Prelec and Simester 2001) to characterize the role of anticipatory somatic response in everyday purchase decisions. By examining participants' anticipatory EDA during a shopping task we shed light on factors that influence the activation of somatic markers and the role of somatic markers in shopping decisions. Specifically, we show that i) cash payment, which is considered more painful than card payment, triggers stronger anticipatory somatic marker activation, ii) the effect of mode of payment on somatic marker activation is more pronounced for vice products that evoke decision conflicts, and iii) somatic markers play an important role in impulse control, helping consumers to regulate impulsive purchase decisions.

Importantly, these results show that the effect of mode of payment on

impulsive purchases cannot be attributed to a simple attentional account. People generally assume that card payments trigger more spending because of "mindlessness." More specifically, it is assumed that because credit cards offer an almost limitless supply of money, shoppers do not bother to keep track of the prices and therefore spend more on discretionary products. Per this account, if shoppers become "mindful" they can easily override the effect of mode of payment on their shopping decisions. The present set of results challenge this view and suggests that the effect of mode of payment is caused by a more deep seated psychological process. Mode of payment can modulate the somatic markers of decision conflict. And it is this modulation that influences impulse regulation. Therefore, even if people pay close attention to the price of the product while shopping, when they are paying with card, the prepotency of somatic markers would be lower, thus reducing their ability to identify decision conflict. This will make them more susceptible to impulsive urges.

The French philosopher Descartes postulated that the nonmaterial mind controls the material body; the mind regulates the acts of passion that emanate from the body. Contrary to Descartes' postulation of the dualism between body and mind, other philosophers, notably Spinoza, have suggested that the human brain relies on bodily signals to identify situations that require vigilance and caution. Thus, advantageous and rational decision making relies on bodily cues such as quickening of heart beat and sweating of palms. This was first demonstrated by Bechara et al. (1999) who showed that normal human beings rely on somatic markers to identify responses that can lead to adverse consequences in the long run. These researchers identified biological impairment, specifically brain lesions, as a determinant of the prepotency of

somatic markers. In this research, we extend Bechara et al.'s work in an important way. We show that not only biological impairments such a brain lesions, even mundane contextual factors such as mode of payment can modulate the intensity of somatic markers. This demonstration, that something as mundane as mode of payment can modulate the intensity of somatic markers, substantially extends the scope of the somatic marker hypothesis.

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APPENDIX

Appendix 1A. Affectiva's Skin Conductance Measurement Device

All participants in Study 1 wore Affectiva's skin conductance measurement device while answering a questionnaire on the computer screen. More details about the apparatus are available on the product website: http://qsensor-support.affectiva.com/

Appendix 1B. Procedure for Study 1 (Paper 1)

All participants first saw this initialization screen. Initialization screen is where baseline skin conductance (EDA) was measured.

FOOD STUDY

This is a survey on consumption rates of some food items. Please respond to the questions truthfully.

I AM READY

Appendix 1B. Procedure for Study 1 (Paper 1) (continued)

DAILY & ANNUAL DELIBERATIVE CONDITIONS

Participants assigned to the daily [annual] deliberation condition read the following instructions.

> *On the following screens, you will see several food categories, one at a time. For each food category, please indicate how many servings you consume per day [per year]. One serving for each category is the quantity of food suitable for or served to one person on one serving occasion. The serving size is often provided on the label. If you are not aware of the serving size for a food category, you can make an estimate based on common sense. For example, it is reasonable to assume that 1 can of soda is 1 serving size.*
>
> *Just enter a number indicating the number of servings that you consume per day [per year]. If you do not consume this category at all just enter 0. Please do not enter text or other symbols in the response field.*

Then they submitted the daily [annual] consumption rate for each food item. Each food item was presented on a separate screen and participants submitted their responses using an open-ended text box. Then they reported the consumption regret (see below).

NATURAL EVALUATION CONDITION

Participants assigned to the natural condition were not asked submit their consumption rates. They directly reported their consumption regret (see below).

CONSUMPTION REGRET

All participants then saw the following screen, explaining to them the main dependent variable.

> *People often have conflicting feelings about food they consume. On the one hand, they enjoy consuming food that they crave; so they want to consume more of it. On the other hand, they regret consuming too much of it because it might be unhealthy in the long run.*
>
> *For each food item shown on the following screens, consider your consumption rates and indicate how regretful you feel about your consumption. You have to indicate the intensity of your regret using the given scale.*

Then they saw the nine food items, each item on separate screen. Participants indicated their consumption regret for each item on a 5-point scale wherein 1= “no regret at all” and 5= “very strong regret.”

Appendix 1B. Procedure for Study 1 (Paper 1) (continued)

OTHER MEASURES

All participants reported their gender, age, and dominant hand.

Appendix 2A. Procedure for Study 2 (Paper 1)

Participants assigned to the weekly extent deliberation condition first estimated and evaluated their consumption extent then reported their consumption regret. On the other hand, participants assigned to the natural condition first reported their consumption regret then estimated and evaluated their consumption extent.

CONSUMPTION EXTENT ESTIMATION AND EVALUATION

Participants read the following instructions.

WEEKLY CALORIE CONSUMPTION

On the following, you will see several food categories. You have to indicate how many calories from that particular food category you consume per week. There are no correct or incorrect responses for these questions. We are interested in your truthful estimates.

On the following screen, they read the following instructions.

For each food category shown below, please indicate how many calories you consume per week. Just enter a number indicating the number of calories that you consume per week. Please do not enter text or other symbols in the response field.

Then they saw the six food items, all on the same screen, and submitted the weekly calorie consumption amount for each food item using an open-ended text box.

For each category, please indicate whether you think your consumption amount is low or high.

Participants subjectively evaluated their consumption extent for each item on a 5-point scale wherein 1= “Low” and 5= “High.”

Appendix 2A. Procedure for Study 2 (Paper 1) (continued)

CONSUMPTION REGRET

All participants then saw the following screen, explaining to them the main dependent variable. The instruction for the participants assigned to the deliberation condition included an additional sentence contained in the square bracket below.

> *People often have conflicting feelings about food they consume. On the one hand, they enjoy consuming food that they crave. On the other hand, they regret consuming it because it might be unhealthy in the long run. For each food item shown below, indicate how regretful you feel about your consumption. [Try to consider calories in the food items to assess your regret.] You have to indicate the intensity of your regret using the scale below.*

Then they saw the six food items, all on the same screen. Participants indicated their consumption regret for each item on a 5-point scale wherein 1= "no regret at all" and 5= "very strong regret."

OTHER MEASURES

All participants reported whether they were involved, attentive, careful, and thoughtful during the study (1=strongly disagree, 5=strongly agree) and indicated their mood (1=very bad, 7=very good), gender, age, height and weight. The same measures were used in Study 2, Study 3, and Study 4.

Appendix 2A. Procedure for Study 2 (Paper 1) (continued)

INSTRUCTIONAL MANIPULATION CHECK

Recent research on decision making shows that choices are affected by context. Differences in how people feel, their previous knowledge and experience, and their environment can affect choices. To help us understand how people make decisions, we are interested in information about you. Specifically, we are interested in whether you actually take the time to read the directions; if not, some results may not tell us very much about decision making in the real world. To show that you have read the instructions, please ignore the question below about how you are feeling and instead check only the 'none of the above' option as your answer. Thank you very much.

Please check all words that describe how you are currently feeling.

☐ Interested	☐ Hostile	☐ Nervous
☐ Distressed	☐ Enthusiastic	☐ Determined
☐ Excited	☐ Proud	☐ Attentive
☐ Upset	☐ Irritable	☐ Jittery
☐ Strong	☐ Alert	☐ Active
☐ Guilty	☐ Ashamed	☐ Afraid
☐ Scared	☐ Inspired	☐ None of the above

Responses from participants who did not follow the instruction were excluded from the main analyses. The same stimulus and exclusion criterion was used in Study 2, Study 3, and Study 4.

Appendix 2B. Supplementary analysis without excluding participants based on instructional manipulation check or completion time for Study 2 (Paper 1)

DV: Reported regret

Reported regret was compared using a mixed-design ANCOVA with evaluation mode as a between-subjects factor and food type as a within-subjects factor. To reduce the noise potentially caused by the heterogeneity of the online participants, participants' BMI was entered as a covariate in the model. Reported regret was higher when it was evaluated in the natural mode than in the deliberative mode ($M_{natural}$ = 2.61, $M_{deliberative}$ = 2.10), $F(1, 97) = 5.11$, $p < .05$. The pattern of result is identical to the pattern found in the analysis with the response exclusion.

DV: Attention to consumption extent

Reported regret was regressed on extent evaluation, a dummy variable set to 1 for the extent salient condition, and their interaction term. In addition, the model controlled for participants' BMI. The coefficient of extent evaluation was not significant in this model, β = -.06, $p > .11$, suggesting that extent evaluation was not a significant predictor of regret in the natural condition. The interaction between the dummy variable and extent evaluation was significant, β = .28, $p < .001$, suggesting that the effect of extent evaluation was stronger in the extent salient condition. A follow up analysis of simple slopes (Aiken and West 1991) showed that extent evaluation was a positive and significant predictor of regret in the extent salient condition, β = .22, $p <$ .001. The pattern of result is identical to the pattern found in the analysis with the response exclusion.

Appendix 3A. Procedure for Study 3 (Paper 1)

PRIME MANIPULATION

All participants were told that as the first part of several unrelated questionnaires, they will first participate in a study that is related to a campaign in the future. All participants read the following instruction.

> *On the next page, you will be shown a poster that will be used for a campaign in the future. Please take a careful look at the poster. You will be allowed to advance past the poster after a certain amount of time. You will be asked several questions related to the poster later in the study.*

Participants assigned to the affect based prime condition saw the poster shown below.

Appendix 3A. Procedure for Study 3 (Paper 1) (continued)

Participants assigned to the extent based prime condition saw the poster shown below.

Appendix 3A. Procedure for Study 3 (Paper 1) (continued)

DELIBERATIVE CONDITION

Participants assigned to the deliberative condition read the following instructions.

MONTHLY CALORIE CONSUMPTION

On the following, you will see several food categories. You have to indicate how many calories from that particular food category you consume per month. There are no correct or incorrect responses for these questions. We are interested in your truthful estimates.

On the following screen, they read the following instructions.

For each food category shown below, please indicate how many calories you consume per month. Just enter a number indicating the number of calories that you consume per month. Please do not enter text or other symbols in the response field.

Then they saw the three food categories, all on the same screen, and submitted the monthly calorie consumption amount for each food category using an open-ended text box. Then they reported the consumption regret (see below).

NATURAL EVALUATION CONDITION

Participants assigned to the natural condition were not asked submit their consumption amount. They directly reported their consumption regret (see below).

CONSUMPTION REGRET

All participants then saw the following screen, explaining to them the main dependent variable.

People often have conflicting feelings about food they consume. On the one hand, they enjoy consuming food that they crave. On the other hand, they regret consuming it because it might be unhealthy in the long run. For each food item shown below, indicate how regretful you feel about your consumption. You have to indicate the intensity of your regret using the scale below.

Then they saw the three food categories, all on the same screen. Participants indicated their consumption regret for each category on a 5-point scale wherein 1= "no regret at all" and 5= "very strong regret."

Appendix 3A. Procedure for Study 3 (Paper 1) (continued)

MANIPULATION CHECK

Participants saw the poster they were shown earlier and responded to the question shown below on a 7-point scale wherein 1= "Emotional" and 7= "Quantitative."

Some messages are emotional in nature. Some messages use quantitative information In your opinion, is the above message emotional or quantitative?

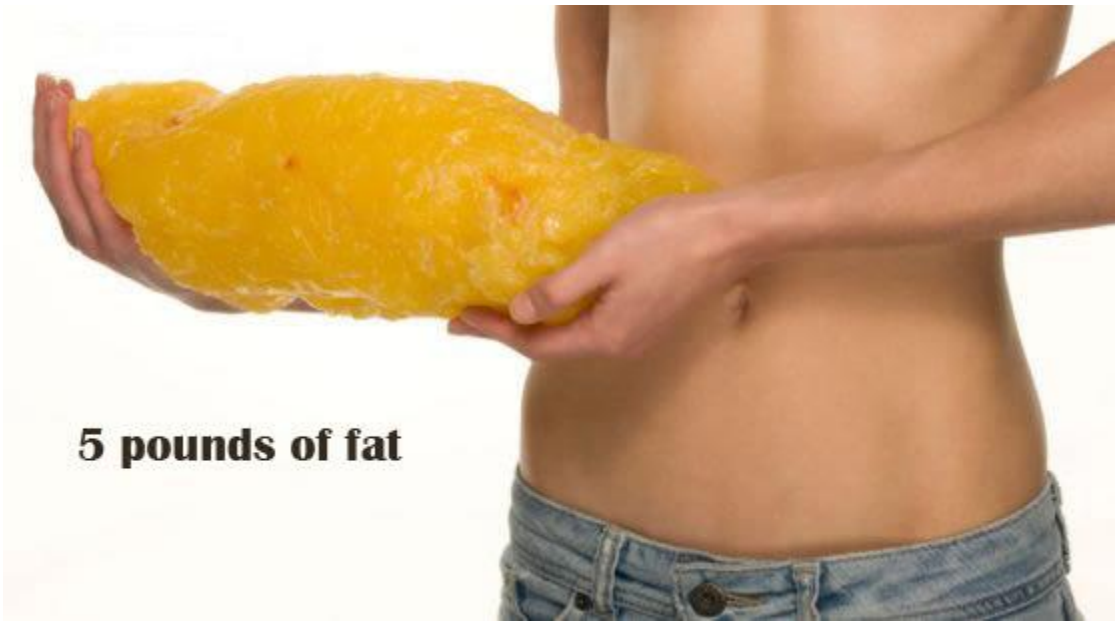
Appendix 3B. Supplementary analysis without excluding participants based on instructional manipulation check or completion time for Study 3 (Paper 1)

DV: Reported regret

Reported regret was submitted to a 2 (evaluation mode: natural vs. deliberative) x 2 (prime type: affect-based (body-fat poster) vs. extent-based (calorie-information poster)) x 3 (food category: burgers & pizzas, fried food, and desserts) mixed model ANCOVA with evaluation mode and prime type as between-subjects factors and food category as a within-subjects factor. To reduce the noise potentially caused by the heterogeneity of the online participants, participants' BMI was entered as a covariate in the model. Reported regret was higher in the natural mode than in the deliberative mode ($M_{natural}$ = 2.74, $M_{deliberative}$ = 2.32), $F(1, 187) = 8.38$, $p < .01$. There was a significant interaction of evaluation mode and prime type, $F(1, 187) = 5.98$, $p < .05$. Planned contrast analyses suggest that when extent evaluation was primed, there was no discrepancy between the behavior evaluations in the natural mode and in the deliberative mode, suggesting that extent-based prime mitigated extent neglect ($M_{natural}$ = 2.56, $M_{deliberative}$ = 2.49), $F(1, 187) = 0.10$, $p > .75$. When affective evaluation was primed, reported regret was higher in the natural mode than in the deliberative mode ($M_{natural}$ = 2.92, $M_{deliberative}$ = 2.14), $F(1, 187) = 14.56$, $p < .001$. The pattern of contrasts is identical to the pattern found in the analysis with the response exclusion.

Appendix 4A. Procedure for Study 4 (Paper 1)

AROUSAL-INDUCING STIMULUS



This stimulus was presented to all participants along with the instructions for calorie consumption estimation task and regret evaluation task shown below.

DELIBERATIVE CONDITION

Participants assigned to the deliberative condition read the following instructions.

MONTHLY CALORIE CONSUMPTION

On the following, you will see several food categories. You have to indicate how many calories from that particular food category you consume per month. There are no correct or incorrect responses for these questions. We are interested in your truthful estimates.

On the following screen, they read the following instructions.

For each food category shown below, please indicate how many calories you consume per month. Just enter a number indicating the number of calories that you consume per month. Please do not enter text or other symbols in the response field.

Then participants assigned to the low [high] perceived diagnosticity of affective evaluation of food condition saw three unhealthy food categories [three unhealthy food categories and three healthy food categories], all on the same screen, and submitted the monthly calorie consumption amount for each food category using an open-ended text box. Then they reported the consumption regret (see below).

Appendix 4A. Procedure for Study 4 (Paper 1)

NATURAL EVALUATION CONDITION

Participants assigned to the natural condition were not asked submit their consumption amount. They directly reported their consumption regret (see below).

CONSUMPTION REGRET

All participants then saw the following screen, explaining to them the main dependent variable.

> *People often have conflicting feelings about food they consume. On the one hand, they enjoy consuming food that they crave. On the other hand, they regret consuming it because it might be unhealthy in the long run. For each food item shown below, indicate how regretful you feel about your consumption. You have to indicate the intensity of your regret using the scale below.*

Then participants assigned to the low [high] perceived diagnosticity of affective evaluation of food condition saw three unhealthy food categories [three unhealthy food categories and three healthy food categories], all on the same screen. Participants indicated their consumption regret for each category on a 5-point scale wherein 1= "no regret at all" and 5= "very strong regret."

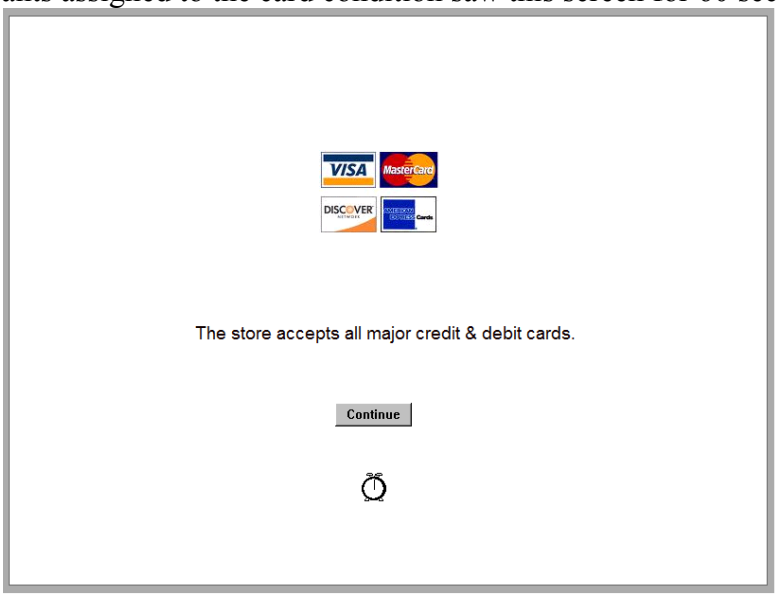
Appendix 4B. Supplementary analysis without excluding participants based on instructional manipulation check or completion time for Study 4 (Paper 1)

DV: Reported regret

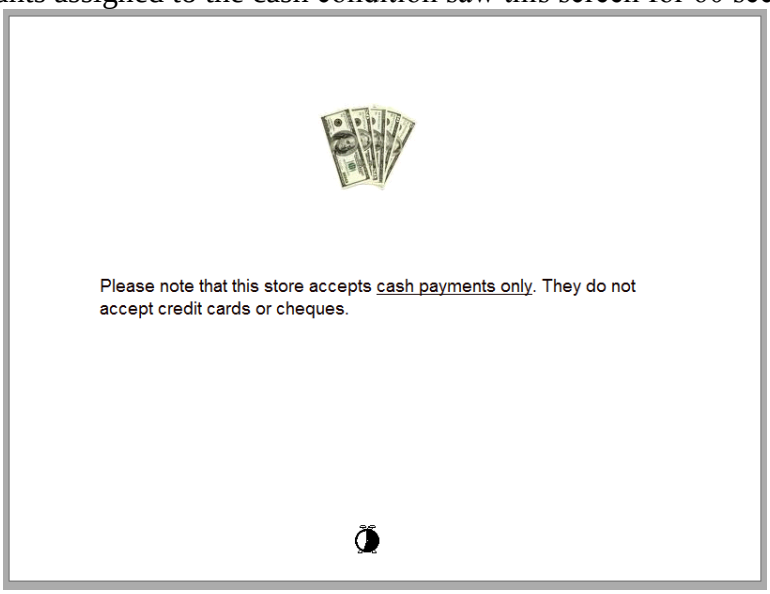
Reported regret was submitted to a 2 (evaluation mode: natural vs. deliberative) x 2 (perceived diagnosticity of affective evaluation: low vs. high) x 3 (food category: burgers & pizzas, fried food, and desserts) mixed model ANCOVA with evaluation mode and perceived diagnosticity of affective evaluation as between-subjects factors and food category as a within-subjects factor. To reduce the noise potentially caused by the heterogeneity of the online participants, participants' BMI was entered as a covariate in the model. There was a significant main effect of evaluation mode. Reported regret was higher in the natural mode than in the deliberative mode ($M_{natural}$ = 2.97, $M_{deliberative}$ = 2.54), $F(1, 195) = 8.22$, $p < .01$. Although the interaction of evaluation mode and perceived diagnosticity of affective evaluation did not reach statistical significance in this analysis, $F(1, 195) = 3.14$, $p = .08$, planned contrast analyses suggest that the predicted pattern of results were found. When perceived diagnosticity of affective evaluation was low, regret reported in the natural mode was higher than regret reported in the deliberative mode ($M_{natural\text{-}low}$ = 2.99, $M_{deliberative\text{-}low}$ = 2.29, $F(1, 195) = 10.83$, $p = .001$. However, regret reported in the natural mode and that in the deliberative mode was not different when the perceived diagnosticity of affective evaluation was high ($M_{natural\text{-}high}$= 2.95, $M_{deliberative\text{-}high}$= 2.79), $F(1, 195)$ = 0.59, $p > .44$. The pattern of contrasts is identical to the pattern found in the analysis with the response exclusion.

Appendix 5 (Paper 2)

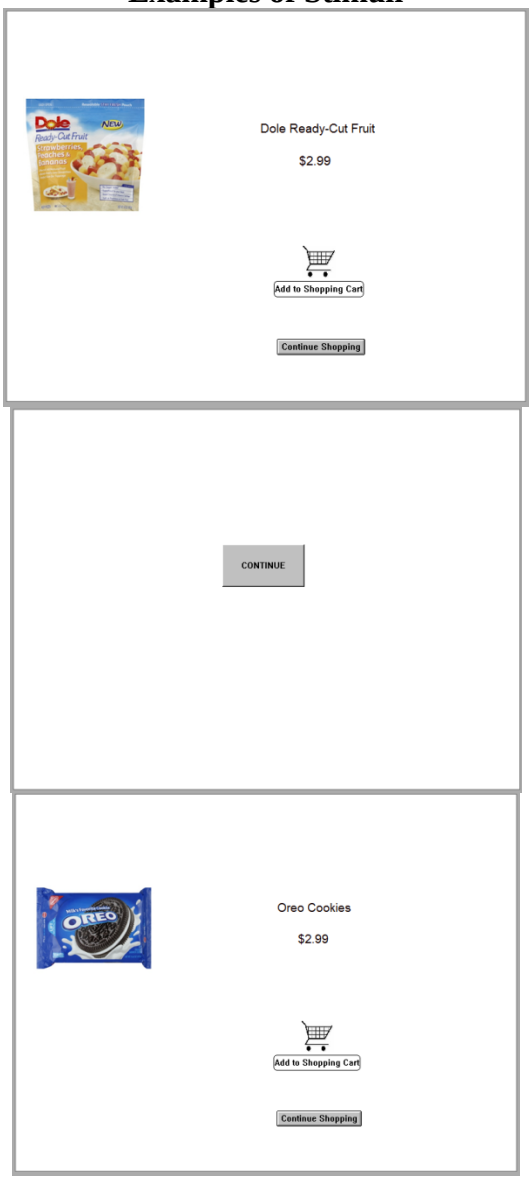
Participants assigned to the card condition saw this screen for 60 seconds….



Participants assigned to the cash condition saw this screen for 60 seconds….



Appendix 6 (Paper 2)
Examples of Stimuli



Appendix 7 (Paper 2)
Price and Pretest Ratings of Stimuli

Product	Price ($)	Impulsiveness Rating	Healthfulness Rating
VICE PRODUCTS			
Little Debbie's Mini Donuts	1.79	4.53	1.18
Little Debbie Marshmallow Fudge Cookies	1.79	4.47	1.24
Perry's Ice Cream Sandwiches	2.99	4.49	1.27
Oreo Cookies	2.99	3.76	1.29
m&m Chocolate Candies 2 pack	1.49	4.31	1.33
Pepperidge Farm 3-layer Vanilla Cake	2.99	4.02	1.39
Lays Classic Chips	2.00	3.63	1.47
TGI Friday's Mozzarella Sticks	3.79	3.90	1.49
Ben & Jerry's Vanilla Ice Cream	2.99	3.88	1.61
Mousse Temptation by Jello	3.59	3.92	1.61
Red Baron Classic Crust Pepperoni Pizza	3.99	2.90	1.71
Jello-O Pudding Chocolate Vanilla Swirls	3.19	3.73	1.73
Heineken Beer 6 pack	7.99	2.80	1.84
Ore-Ida French Fries	2.79	2.59	1.94
Little Debbie Chocolate Chip Muffins	2.59	3.86	1.94
VIRTUE PRODUCTS			
Progresso Light Vegetable Soup	2.49	2.53	3.49
Brownberry Wholewheat Grains Bread	3.99	1.47	3.98
Upstate Farms Fat Free Milk	1.54	1.12	4.02
Dannon Light & Fit Nonfat Yogurt	0.50	2.71	4.12
Quaker Hearty Medley's Hot Cereal	2.99	2.35	4.16
Del Monte Fresh Cut Green Beans	0.79	1.96	4.20
Large Eggs	1.19	1.25	4.24
Birds Eye Steamfresh Fresh Frozen Vegetables	1.99	2.22	4.24
Dole Ready Cut Fruit	2.99	3.25	4.25
Poland Springs Bottled Water	4.49	2.20	4.49
Fresh Farm Raised Salmon	5.49	2.57	4.61
Earthbound Farm Organic Romaine Salads	3.99	1.53	4.73
Green Seedless Grapes	1.99	2.22	4.76
Greenhouse Grown Tomatoes	2.19	1.45	4.76
Pink Lady Apples	1.99	2.06	4.80